SCIENTIFIC AMERICAN

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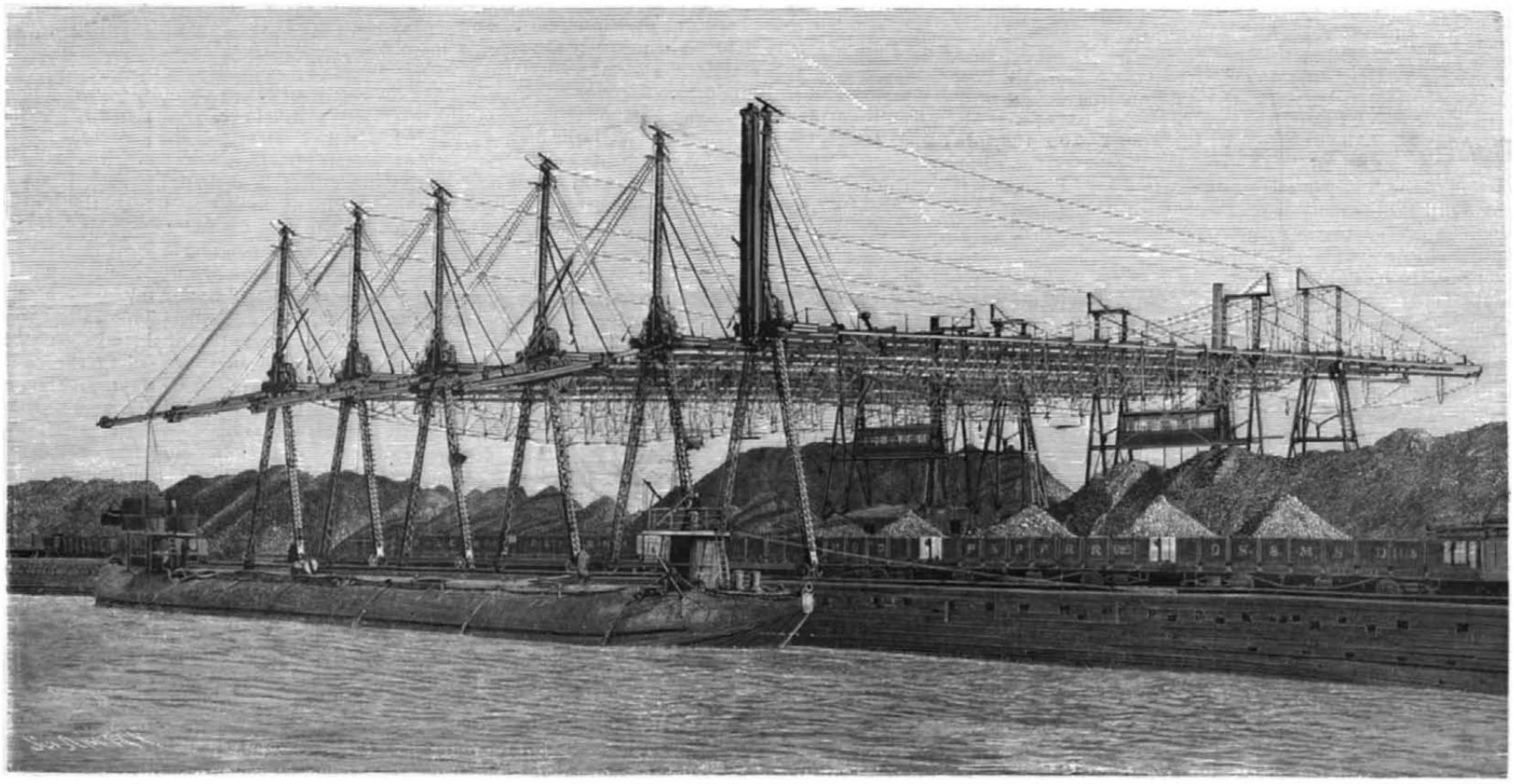
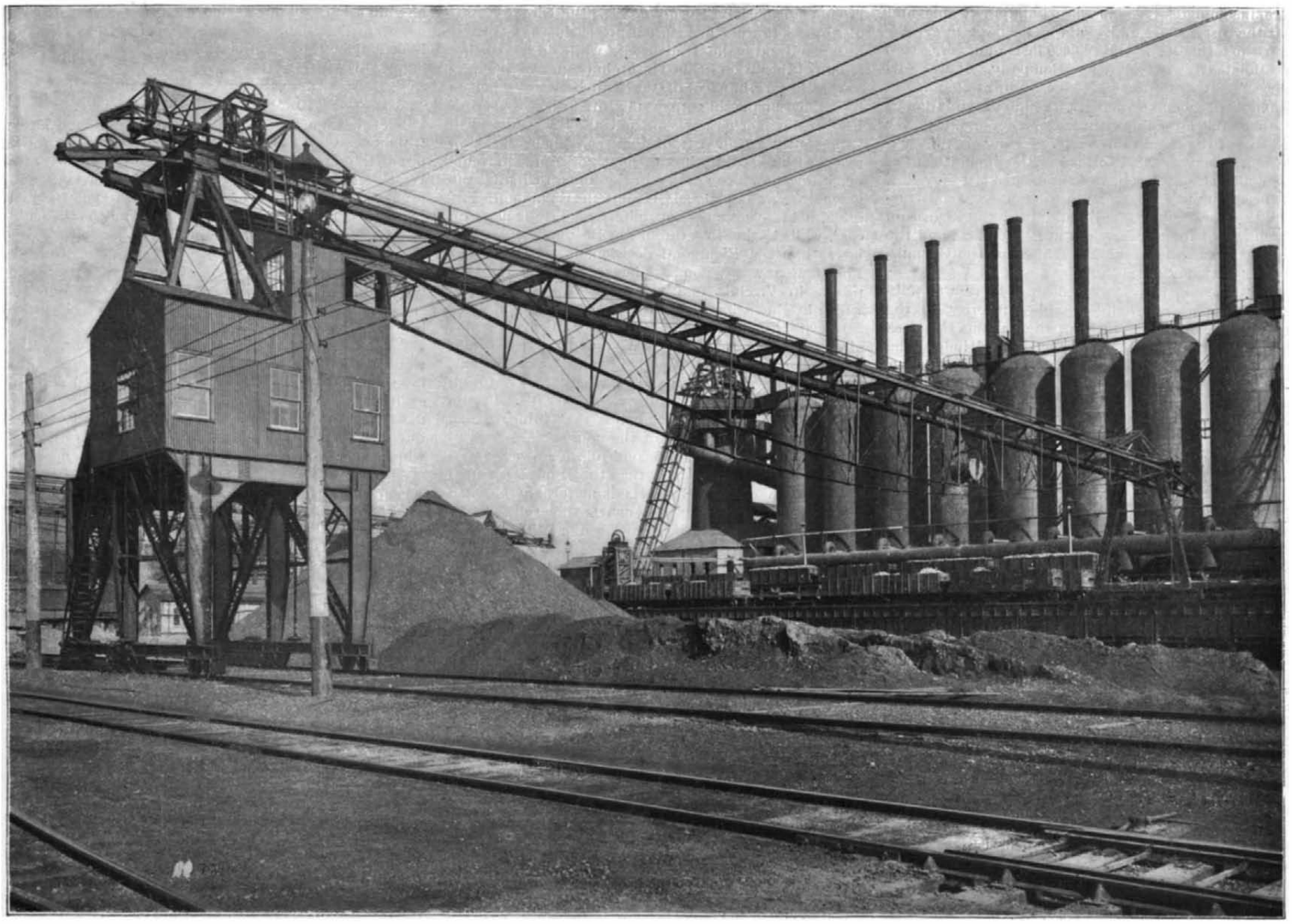
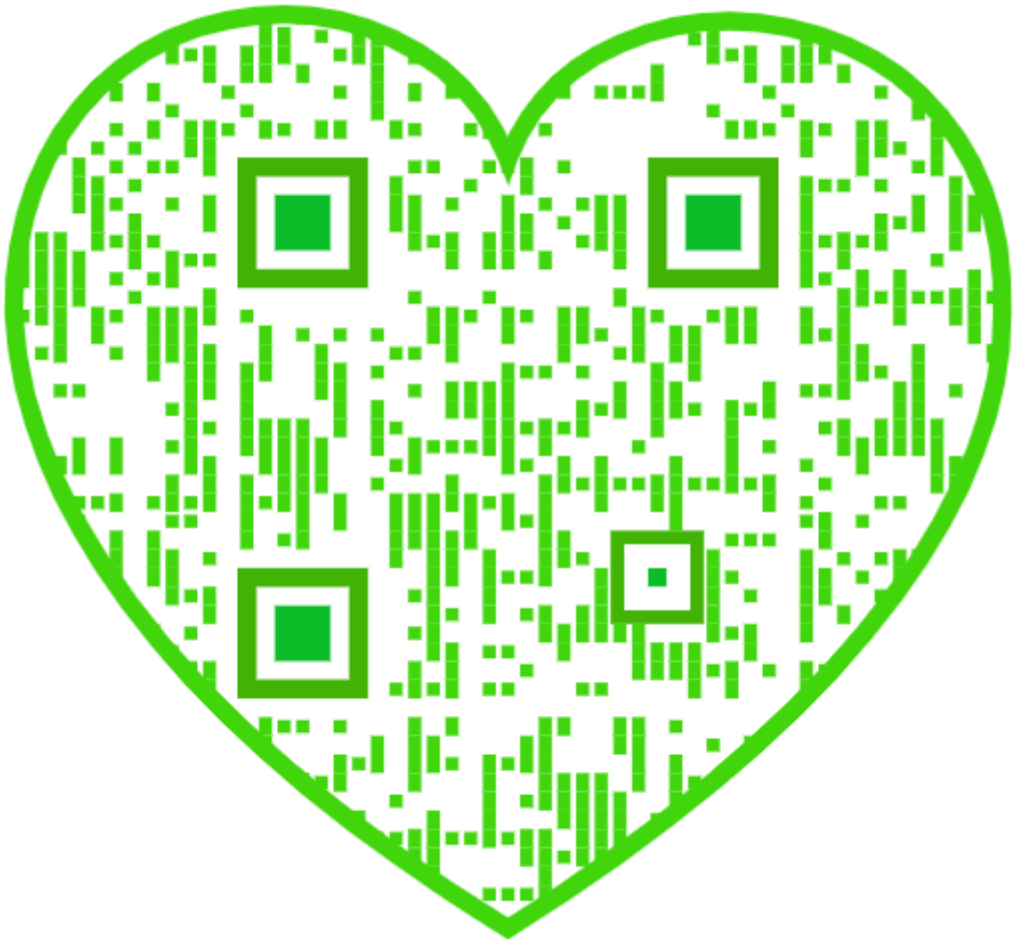


Movable Bridge Tramway Hoisting and Conveying Crane for Handling Coal and Ore, Ashtabula, Ohio.



Bridge Traveling Crane for Handling Ore, at Duquesne Furnaces, Pa.

TRAVELING CRANES.—[See page 85.]



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NEW YORK, SATURDAY, FEBRUARY 10, 1900.

THE NICARAGUA CANAL BILL—AN AFFRONT TO THE NATION.

The action of the House and Senate Committees in reporting a bill for the immediate construction of the Nicaragua Canal, before the expert commission appointed by the President has had time to make its report, is one of the most humiliating affronts ever offered to the Chief Executive of the American nation. Unfortunately, the whole Isthmian Canal question is so technical and so little understood, that the shameful significance of what is just now happening in Congress is little likely to be realized by the mass of the American people. Nevertheless, it is a fact, and we say so deliberately, that the conspiracy on the part of the House and Senate committees to jostle the President and his commission out of the way, and jam this canal bill through Congress with a rush, is a proceeding so brutal, so redolent of the "pot-house politician," as to be almost without a parallel in the history of American politics.

Briefly stated, the history of the Isthmian Canal question is as follows: In 1892, when the Maritime Canal Company, which was attempting to build the Nicaragua Canal, began to run out of funds, the Senate introduced a bill authorizing the Government to guarantee the bonds of the Company to the extent of $100,000,000. Congress very properly refused to do this without investigation, and in 1895 appointed a commission, presided over by General Ludlow, to make a personal examination of the route. This commission reported that the surveys of the Maritime Company were incomplete, its plans largely impracticable, and that the cost of the canal would be 100 per cent greater than the estimate, or $134,000,000 instead of $67,000,000 as estimated by the Maritime Company. It was further suggested that $350,000 be appropriated for a commission to make such a thorough examination as would enable a reliable estimate of the practicability and cost of the canal to be made. Acting on this suggestion, Congress in 1897 authorized the appointment of the Walker Commission, which reported last May that with certain radical changes in the route and construction, the Nicaragua Canal could be built for a sum which two of the members put at $118,000,000, and the third, who was the ranking Engineer of the Commission, estimated at $135,000,000.

During the last Congress, however, there was published a report of unimpeachable authority on the present state and possibilities of the Panama Canal—a scheme which the American public, and indeed the world at large, supposed to be practically defunct. This report was drawn up by an international commission composed of several of the most distinguished canal and hydraulic engineers in America and Europe, who, after a careful consideration of the revised plans for the completion of the canal, reported that they were thoroughly feasible and that the canal could be completed for the sum of $102,000,000. The publication of the report produced a lengthy discussion of the comparative advantages of the two routes, in which it was shown that the Panama Canal would be shorter, 46 miles against 170, that the danger zone, or the length of canal in which ships would be above tide water, would be only 23 miles as against 157 miles, and that two good terminal harbors existed at Panama as against none at Nicaragua. It was stated that the Panama Company would agree to the United States completing the Panama canal and holding the controlling interest, and it was suggested that as this government had already by treaty guaranteed the neutrality of the Panama route, it would be folly to construct a second canal when by taking hold of the Panama project we could secure every advantage of a military or political nature that would accrue at Nicaragua, in addition to other advantages of a physical and commercial nature that existed only at Panama.

During the last Congress a desperate effort was made to rush through a bill authorizing the immediate construction of the Nicaragua Canal; but after exhaustive debate the obviously wise conclusion was reached that it would be better to appoint another commission for the express purpose of examining not merely the Nicaragua and Panama routes, but any other possible route across the Isthmus. The President was accordingly empowered to appoint an Isthmian Canal Commission, and one million dollars was appropriated for its expenses. The commission was dispatched on its mission, and will probably report some time during the coming summer.

Obviously, the proper course is to await patiently the handing in of this report; but for some occult reason, the "friends" of the Nicaragua scheme have undertaken to ignore the President, his commission, and the clearly expressed will of the country, and make a desperate effort to commit the nation to the construction of one particular canal, before the country has been informed whether its route is the best that can be chosen.

In the absence of any explanation of such undignified proceedings, one is driven to the conclusion that the principal movers in this matter are afraid of the forthcoming report, and realizing that Nicaragua may, after all, prove to be inferior to some other location, they are flouting the President and the people in an attempt to "jam" a Nicaragua bill through Congress before the truth has a chance to be made known.

THE BILL FOR ESTABLISHING A HIGH COURT OF PATENTS.

In a previous issue, in which we discussed sundry bills that have been submitted to the present Congress in Washington, we took occasion to comment favorably upon Senator Hansbrough's Bill, No. 1883. The same bill was also introduced in the House of Representatives, and is there known as House Bill No. 5294. An informal hearing took place before the Senate Committee on Patents on Wednesday, January 31, and also before the House Committee on Patents, on the same day. In order that the matter of said bills be more properly understood by our readers, we will here give a brief comment.

The first object of the Hansbrough Bill is to create a Court of Appeals in which patent, trademark and copyright cases shall be finally determined on appeal. The different Circuit Courts are to retain original jurisdiction, but from their decisions an appeal shall be taken, not to the existing Circuit Courts of Appeal, but to the central or single Appellate Tribunal, which under this bill is to be created. All those who have followed the course of decisions in the different Circuit Courts of Appeal since they were established in 1891, cannot fail to observe that a diversity of judicial interpretation has in many cases been given to the same question. Thus, for example, in regard to the supposed trademark on Syrup of Figs, the Circuit Court of Appeals in the Ninth Circuit has held that term to be a good and valid trademark, while in two other circuits it has been held to be an improper trademark; so that in certain parts of the United States a person is justified in putting up a mixture called Syrup of Figs, while in other parts of the United States he will be instantly enjoined from doing so. The same happened with regard to the trademark or supposed trademark Pocahontas on coal. In the Fourth Circuit, the Circuit Court of Appeals sitting in Richmond, Virginia, held Pocahontas not to be a good trademark on coal, while in the First Circuit, in Boston, in a decision later than the Richmond decision, it was held that Pocahontas was a good trademark on coal; so that people in Virginia may sell under that name that which in Massachusetts will be absolutely prohibited.

In patent matters a similar grade of confusion has already commenced to arise. We may refer to a certain windmill patent which was held valid by one Circuit Court of Appeals and invalid by another. Confusion thus created results in a multiplicity of evils. In the first place, the more direct evil is that things which are permitted in one part of the country are prohibited in another. In the second place, however, and the more important evil, is that the respect for final adjudication of federal courts is materially lessened whenever it appears that the courts themselves are at loggerheads. Hence the Hansbrough Bill deserves and receives our commendation, because it seeks to do away with every possibility of conflicting decisions.

It moreover particularly provides that whenever, in the opinion of the Supreme Court of the United States, it seems proper that the decision of the final Court of Appeals be brought up for review, the power to do so is specifically lodged in the Supreme Court. When we consider the vast amount of capital invested in patented inventions, the protection required by inventors to sustain their valid patents and by the public at large to have invalid patents properly branded as such, the necessity for a single tribunal which will shape the course of patentees and duly instruct them as to their rights, will do away with a great deal of unnecessary friction and litigation.

But apart from the matter of patents, we all know that lately the matter of trademarks has assumed a degree of importance heretofore not sufficiently appreciated. We cannot buy any article of manufacture, from a box of shoe blacking up to the finest tool, regarding which the name of the producer, his peculiar label or trade indication is not deemed a guarantee of genuineness. It may be safely stated that most of the capital that is invested in the manufacturing industries of the country which is not based upon patents is based upon the right to trademarks and trade names. Their protection, therefore, is of perhaps still greater importance than that of patents. For this reason the uniformity of decision which will follow the adoption of Senator Hansbrough's Bill will be of the utmost value to every inhabitant of the country.

Another branch of Senator Hansbrough's Bill deals with the abolition of the existing Circuit Courts of Appeal. This is a matter which, in our capacity as spokesman for inventors and manufacturers, does not enter our jurisdiction as fully as the branch already touched upon. Nevertheless, we are informed, on inquiry, that the present condition of affairs is coupled with many objectionable features. We now have nine circuit Courts of Appeal. The circuit judges sit as appellate judges; their courts are in the same buildings in which the judges who hear cases originally also hold forth. Necessarily local prejudices and local interest are liable to affect, therefore, the one of these tribunals as much as the other. Principal, however, is the objection that the circuit judges who take their places are in personal touch with the judges who sit over them on appeal; that matters pending in the Circuit Courts might, therefore, be frequently discussed by all the judges, and that the appeal finally taken by one who deems himself aggrieved by a decision of the Circuit Court is frequently taken to two or three judges whose opinions have already been expressed to the circuit judge below and who, therefore, are not properly qualified to sit on appeal. Hence in all matters of litigation the Appellate Tribunal should be removed from personal contact with the lower court.

A similar principle is applied in the State courts of nearly every State, very pointedly in those of the State of New York. The Court of Appeals in Albany is not in touch personally with the judges who hear cases originally, nor with those of the General Term. In this manner, therefore, the Hansbrough Bill, in seeking to remove all appeals from local circuits and bring them into the city of Washington for final disposal, operates in a direction to which we can only give our most sincere approval.

Of the desirability of establishing a final Court of Appeal for patent cases, there can hardly be two opinions. The abolition of the existing Circuit Courts of Appeal, however, is a matter which doubtless admits of much discussion. The two questions, in our opinion, may, therefore, well be presented to Congress in separate bills, so that each proposition may be determined without affecting the other. It is to be hoped that the sponsors of the Hansbrough Bill adopt this course.

DISTANCE AND SPEED.

The question raised by a correspondent in a letter which we publish in another column, as to the proper use of the term "knots" in speaking of the speed of a vessel, is capable of a broad application, and touches a wide variety of technical subjects, in which reiterated use is made of terms relating to speed and power. Speaking literally, our correspondent is correct when he says "if the word indicates a measure of speed, then the words 'an hour' are superfluous, and incorrect. If it is a measure of distance, then in referring to the speed of a vessel it should always be followed by the words 'an hour.'"

When used alone, without any qualifying phrase, the word "knot" is unquestionably a measure of distance, as when we say that a ship has traveled a thousand knots, where we merely wish to indicate the distance covered without any reference to the speed; but when the term is qualified by a statement of time, whether written or understood, it becomes a measure of speed. Strictly speaking, when used to indicate speed, the term should never be written without a qualifying phrase. Custom, however, has sanctioned the occasional use of "knots" without the qualifying "an hour." Our own practice is to use the abbreviated form only when, as in the case quoted by our correspondent, the full form "knots an hour" occurs in the context. Parallel cases are to be found in the description of the velocity of guns or the speed of railway trains, where the phrase "velocity of 3,000 feet" is used, meaning 3,000 feet per second, or where a train is spoken of as running at a "40-mile" speed, meaning that it is running at a speed of 40 miles an hour. The tendency toward abbreviation is strong in this busy age, however much the purists may deplore it, and this tendency is nowhere more manifest than in the English language, especially as used in America. It is not improbable that, before the century is very far advanced, the term "knots," where the context is such as to show that it cannot refer merely to distance, will be in universal use to designate speed. Ordnance men have overcome the difficulty by making use of the compound term "foot-seconds," and another instance of abbreviation is found in the term "watt-hours." In the special case under consideration, moreover, where the context is such as to prevent any ambiguity as to the precise meaning of the writer, considerations

of euphony call for the occasional omission of the redundant "an hour." The repetition of these qualifying terms every time we mention the speed of a vessel or train, or the velocity of a projectile, would in many instances become positively irritating.

REGULATION OF THE NICARAGUA CANAL SUMMIT LEVEL.

Unquestionably the problem of regulating the summit level of the Nicaragua Canal, a letter upon which subject will be found on another page, is one of the most important connected with that colossal undertaking, and as far as our study of the question has gone we are inclined to think that at the present stage of the investigation it is not only one of the most important problems, but one upon which there is a call for more complete and reliable data than is at present available.

A study of the various reports which have been made on the Nicaragua project shows that every engineer who has investigated it looks upon the question of the regulation of the summit level as one that must be faced and satisfactorily settled before any other, since upon the complete control of the summit level depends the success of the whole canal. We consider that the report of General Ludlow of 1895 contains the most conservative, unbiased, and sagacious estimate of the possibilities of Nicaragua that has been made to date. Unfortunately the Commission was not given sufficient time to make the necessary gagings and obtain the proper hydraulic and other data necessary for a complete report. The project of the Maritime Canal Company, upon which the report was made, contemplated maintaining the lake at a minimum elevation of 110 feet above mean tide. Commenting upon this, the report pointed out that the gagings of Childs, in 1851, and of Lull, in 1873, mentioned a low water level of 102 28 feet and that it was not certain that these gagings were taken at extreme low water. The gagings by the Ludlow Board, in 1895, showed a low water stage of 101·8 feet and a measured discharge of 9,420 cubic feet a second. Lull's profile, moreover, showed that on May 2, 1872, the lake was only 100·87 feet above mean tide. Again, the officers of a steamboat plying on Lake Nicaragua pointed out to the Ludlow Commission a low water mark of 98·6 feet, a reading which was confirmed by residents at the head of Lake Nicaragua, who further indicated a ledge of rock whose elevation was 98·5 feet, which had been bare at low water. William Climie, a civil engineer, who has resided in Nicaragua for many years, reported a low water stage of 97·6 feet above mean tide. The discharge at this last stage was only 3,400 cubic feet per second.

The problem of regulating the summit level, briefly stated, is this: The engineer must determine upon a minimum summit level, at which the minimum allowable depth of water in the canal at the summit level, including, of course, the lake, will be maintained, and if the inflow into the lake during the dry season is less than the amount of water lost by evaporation, by outflow through the river San Juan, and by lockages, then water must be stored either in the lake itself or in its feeders, in sufficient quantities to make up, and more than make up during the dry season, for that lost by evaporation and other causes. General Ludlow estimates that the lake would be lowered in sixty days, if there were no inflow and no discharge except for canal purposes, about 1½ feet, and that if the lake is to be at 110 feet at the end of the dry season, it must be at 111½ feet at the commencement of it.

In addition to maintaining the summit level, there is the problem of controlling the discharge of the surplus waters in the wet season. While this is just as important for the success of the canal, it is not perhaps so difficult, if a suitable means of getting rid of the surplus waters can be found. The Walker Commission propose to provide large spillways or movable weirs both on the San Juan River to the east of the lake and on the Rio Grande to the west of it, the former to have a maximum capacity of 85,000 and the latter of 20,000 cubic feet per second. They suggest that the lake be controlled between a maximum elevation of 110 and a minimum of 104 feet, by arranging to have it 108 feet at the approach of the dry season, drawing it down to 106 feet during this season, and allowing it to rise during the wet season to 108, at which level the spillways would be opened and the subsequent rise held under control. This proposal to regulate within a range of 6 feet is qualified by the fact that the United States own records of rainfall, etc., are not sufficient to give these estimates the absolute reliability that an undertaking of this magnitude demands. More complete data, however, are now being gathered by the Walker Commission.

The magnitude of the problem of regulation may be judged from the fact that in an extreme dry season the figures of the Commission show that storage must be provided sufficient to raise the level of the lake by 4 feet over its whole area of 3,000 square miles. This represents an amount of water equal to about 2,700,000,000,000 gallons, or about ninety times as much as will be contained in the new Croton reservoir. In an extreme wet season it will be necessary to take care of a flood of water that would raise the level of the lake about 9 feet, an amount that would fill the great Croton reservoir two hundred times over. Facts such as these rebuke the unseemly haste with which Congress would rush the nation into the active construction of this stupendous work before the engineers have time to fully complete their investigations.

REPORT OF THE SMITHSONIAN INSTITUTION.

Dr. S. P. Langley, secretary of the Smithsonian Institution, has just issued his annual report for the year ending June 30, 1899, which gives a general idea of the affairs of the institution and its bureaus. The operations of the institution are constantly on the increase, and in many cases science is not only being advanced by researches actively promoted in nearly every department of knowledge by its own officials, and by the preparation of the results for publication, but it is also carried on by grants to special investigators and explorers. Through the National Museum, the Bureau of Ethnology, the National Zoological Park, the Astrophysical Observatory, researches are encouraged in all branches of natural history, zoology, anthropology and astrophysics both by the opportunities afforded in Washington and by aid given students elsewhere. The institution issues and freely distributes three classes of publications and the instruction of the people is not forgotten, since through the museums and parks great object lessons are placed before hundreds of thousands of visitors to the national capital from all parts of the United States. There are 31,000 correspondents, of which 20,000 are in Europe and Asia, thus facilitating the exchange of publications and intercourse between governmental and learned societies, institutions and scientific men.

Standing near the threshold of the second half century of the institution's life, it is plain to see that scientific conditions have changed, and it is easy to estimate the relative position which the institution holds to American and foreign scientific endeavor. The most noteworthy fact is the much greater esteem in which American science is held abroad, the better knowledge had of its representatives and the more friendly and even intimate relations between American workers and their foreign colleagues. To this end it may unquestionably be said that the institution has contributed a very large share and that its influence abroad has so notably increased during the past ten years as to constitute a very gratifying fact. The institution is recognized by the Department of State as the adviser in matters relating to international science, and there is probably no department or bureau of the government which does not at some time or other require the aid of some member of the staff of the institution. The total permanent fund of the institution amounts to $912,000, and the total receipts for the year were $66,023, and during the fiscal year 1898-99 Congress charged the institution with the disbursement of the following appropriations: International Exchanges, $21,000; Bureau of Ethnology, $50,000; Preservation of the Collections of the National Museum, $165,000; other items, $82,000; the National Zoological Park, $65,000; and the Astrophysical Observatory, $10,000. Estimates for the fiscal year ending June 30, 1900, were considerably larger than this amount, and a larger portion of the sum asked for was appropriated.

A small room has been set aside in the institution building in the south tower, and alterations have been made with a view to increasing its light and cheerfulness, and plans are being prepared for the purpose of bringing together in a simple and attractive manner objects which may be of interest to children. This will tend to awaken the minds of the children who may see the collection and also set an example which may result in other collections being arranged for children in various parts of the country. There is already a museum of this kind in Brooklyn of considerable proportions belonging to the Brooklyn Institute. Various other improvements have been made in the buildings. The institution has found it possible to render aid to investigation by means of the income of the Hodgkins fund. As in past years a large amount of exploration work has been accomplished by the institution through the National Museum and the Bureau of Ethnology, particularly in anthropology and natural history lines. It was found possible to make limited investigations in Porto Rico, and when the time is opportune it is hoped that extended explorations can be made in our new possessions. A number of publications were issued and the number of volumes, pamphlets, charts, etc., added to the library aggregated 36,663. The great majority of these were transferred to the Smithsonian collection in the Library of Congress.

Delegates attended the International Congress of Zoology, the International Congress of Orientalists, and the Conference on an International Catalogue of Scientific Literature. Several bureaus of the institution participated in the Trans-Mississippi Exposition at Omaha, and preparations are being made for making an exhibit at the Pan-American Exposition at Buffalo, in 1901. The acquisitions to the National Museum during the past year numbered 200,000 specimens. A considerable number of valuable animals have been added to the Zoological Park. The primary object for which Congress established the Zoological Park was the preservation of the fast vanishing species of the American animals, and circulars have been prepared by the secretary describing the Zoological Park, and these have been distributed to United States officers throughout the world, and they are thus informed of the special needs of the Park, and the best methods of caring for the animals to be transported have been explained. The operations of the astrophysical observatory during the last year have been of continued interest, although the work is done under difficulties, owing to the excessively confined quarters, which were originally intended only for temporary sheds for the instruments.

Personal investigation into the phenomena of the Welsbach mantle have been conducted with the bolometric apparatus by the Aid Acting in Charge. The curves obtained show that all artificial lights are most extravagantly wasteful of energy in that they are absorbed in the infra-red and not in the visible spectrum. Nature here, as elsewhere, does what we cannot, for the glow-worm and the firefly are still able to confine their exertions to the production of light with comparatively little heat, and they set us an example which would add millions to the nation's wealth if we could imitate it successfully on a commercial scale.

THE FOREIGN COMMERCE OF THE UNITED STATES IN 1899.

In 1899, the foreign commerce of the United States amounted to over $2,000,000,000, and of this enormous sum more than three-fifths was exports, and less than two-fifths imports. The Bureau of Statistics of the Treasury has just issued some figures showing that the imports were $799,834,620, while the exports amounted to $1,275,486,641; the excess of exports over imports was $475,652,021. This is a larger excess than in any preceding year with the exception of 1898, and of these exports, manufactures form a larger proportion than ever before, while on the other hand raw materials for the use of our manufactures form a larger proportion than ever before. Of the exports, more than 30 per cent are manufactures against 26 per cent in the fiscal year of 1897, 23 per cent in 1895, 20 per cent in 1885 and 12 per cent in 1860, and of the imports 33 per cent are articles in a crude condition which enter into the various processes of domestic industry, and products of agriculture form 63 per cent of the exports against 70 per cent in 1898 and 83 per cent in 1880. The wonderful growth of our export trade is an indication of our great prosperity.

AN INTERNATIONAL ASSOCIATION OF ACADEMIES.

The special committee appointed by the Royal Society of London has given an account of the preliminary conference held at Wiesbaden for the organization of an international association of academies, which is to be carried out upon the following basis. The association will consist of a general assembly and a council of administration. The general assembly will be formed of delegates sent by the different academies, each academy having the right to send as many delegates as it considers necessary, but as to questions of organization, each academy will have but one voice. The assembly will unite once every three years, but in certain cases this time may be modified. It will be divided into two sections devoted respectively to the sciences and to literature and philosophy. These sections may hold separate meetings, and the decisions or information which may be arrived at in either section will be brought before the general assembly for confirmation. In the intervals between the meetings of the assembly, the affairs of the association will be conducted by a council formed of one or two representatives sent by each academy.

THE WORLD'S PRODUCTION OF PRECIOUS METALS.

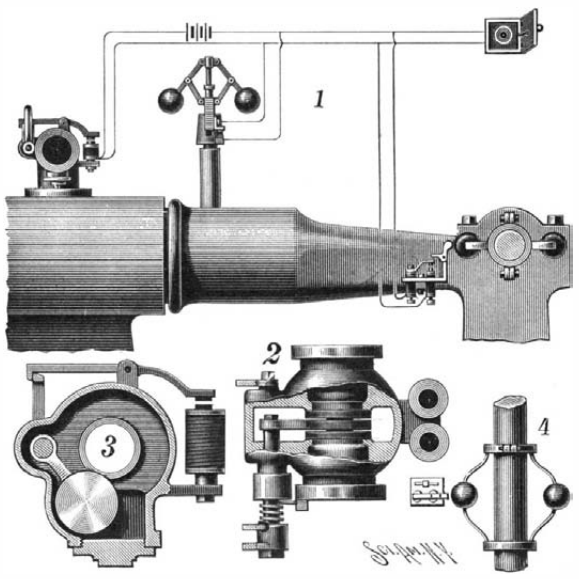
The year 1899 would have been a record breaker in the production of gold, had it not been for the conditions in South Africa, but it is estimated the production will amount to 968,000 pounds. The Witwatersrand will probably, after peace has been restored, produce 5,000,000 and the other districts in Africa 250,000 ounces, or approximately double the production of 1897. The United States, Australia and Canada also contribute an increase, so that the twentieth century will commence with a yearly production of about 1,014,000 pounds, of a value of $305,360,000, which means that the output of gold alone will exceed by $119,000,000 the average production of gold and silver combined in the years between 1866 and 1870. From the discovery of America up to the year 1899, there were produced 32,514,329 pounds of gold.

THE sum of $7,550 has been given by Profs. Haeckel, Conrad and Fraas to be awarded for the best essays submitted on the application of the Darwinian theory to international political development and legislation. The essays must all be submitted prior to December, 1902.

AN AUTOMATIC DEVICE FOR STOPPING ENGINES.

An improved device has been invented by John J. Kaye, of Newburg, N. Y., which is designed for stopping an engine in an emergency either automatically or manually, without the aid of an engineer. Fig. 1 is a side elevation of an engine with the improvement applied. Fig. 2 is a sectional plan view of a gate-valve employed. Fig. 3 is a sectional side elevation of the gate-valve. Fig. 4 shows a speed-limiting arrangement.

Between the steam-supply pipe and the boiler a gate-valve is arranged, which suddenly shuts off the steam in case of an emergency or when the engine runs at a



KAYE'S AUTOMATIC DEVICE FOR STOPPING ENGINES.

speed in excess of the normal. The gate consists of disks hung on an arm secured to the inner end of a shaft. A spring, coiled about the shaft, serves to close the valve. The valve is normally held open by means of a locking device consisting of a U-shaped arm connected with the valve shaft, which arm is engaged at its middle by the hook end of the armature lever of a pair of electromagnets. These electromagnets are in a main circuit containing a battery and a push-button incased in a box located at any distance from the engine, so that in case of emergency, the button can be pressed to complete the circuit and cause the electromagnets to attract the armature-lever, thereby moving the hook out of engagement with the arm and causing the spring to turn the shaft in order to swing the gate-valve into closed position. The steam is thus cut off almost instantaneously. A number of push buttons can be distributed about a factory, all connected with the engine furnishing power, so that all machinery can be stopped whenever it may be necessary.

A branch-circuit is connected with a speed-limit device consisting of springs secured at one end to a support fixed to the engine-shaft, and at the other end to a cam sliding on the engine-shaft. Balls are held on the springs (Fig. 4), and are forced outward when the speed becomes excessive, thereby impinging against a lever which automatically operates a circuit-closer and actuates the gate-valve in the manner described.

A second branch-circuit is connected with a circuit-closer applied to the governor. When for any cause the governor refuses to operate and the balls hang down, then the circuit is automatically closed and the steam cut off by the gate-valve. Hence when the governor and co-operating parts are injured, the engine is almost instantly stopped. The gate-valve when it has been closed can be reset by means of a handle attached to the valve-shaft.

NODES AND LOOPS.

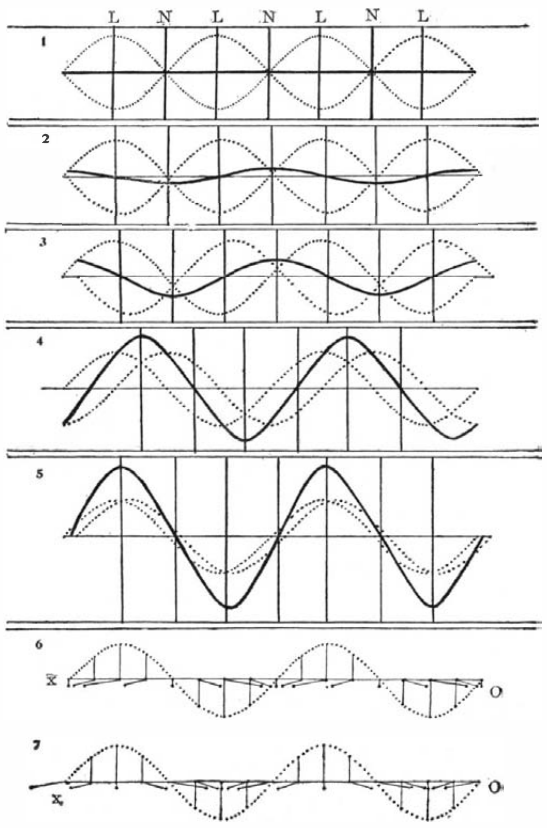
BY M. J. HOFERER, S.J.

To anyone who has ever attempted to explain the action of sound waves in an organ pipe, the contrivance shown will at once commend itself. Ordinary textbook diagrams serve only to bewilder the student on this somewhat intricate point in physics. He is constrained to fix his attention at one and the same time upon two different longitudinal waves meeting each other at every possible phase and always under the guise of sine curves. What a relief could he turn from the lifeless page of his book to an illuminated screen where the direct and reflected waves might be seen moving toward each other with perfect distinctness, and the resultant showing itself at every instant with infallible accuracy, and where, above all, the corresponding longitudinal waves might be seen advancing side by side with their disguised representatives! Such precisely is the result obtained by the sound-wave lantern-slide. It was devised by the writer under pressure of the above difficulty.

It consists of a wooden frame of a size suited to the lantern and four half-inch rollers about which moves a transparent belt of celluloid film. Upon this is traced a sine curve together with the corresponding longitudinal waves represented by dots properly spaced. The two inner rollers serve merely to bring both parts of the belt together into focus, as shown in the separate view. A wire sine curve which revolves once for every wave on the belt represents the resultant of the direct and reflected waves at every possible phase of combination. This wire sine curve is connected with one of the rollers by means of small cogwheels. Now, by turning the thumb-screw at the end of the slide, the rollers are made to revolve, and one part of the belt to move to the right and the other to the left, thereby causing the waves to advance toward one another continuously. The wire sine curve keeps exact pace with the two waves and shows at every instant the algebraic sum of their combined ordinates. The perpendicular dark lines crossing the field mark the position of the stationary nodes and loops.

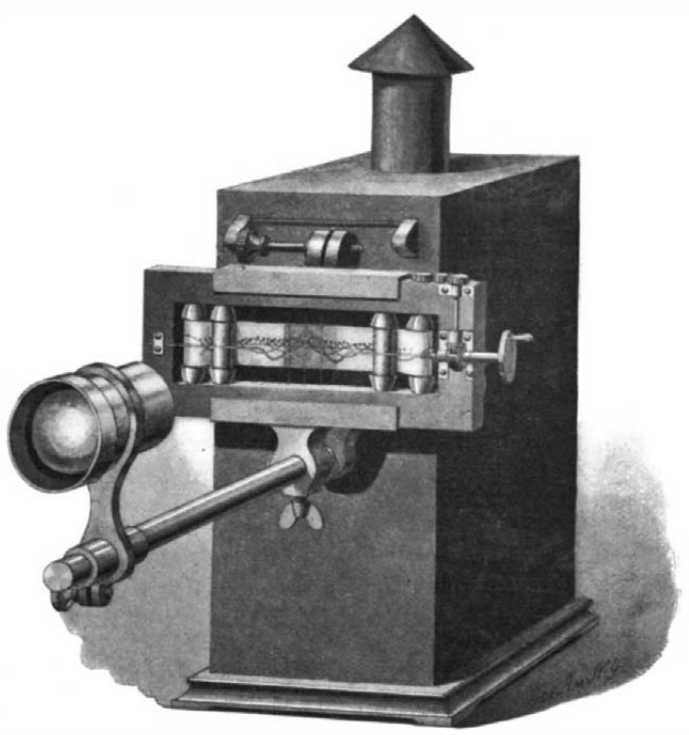
The practical results of the apparatus will be better understood by inspecting the accompanying diagrams. The first five show the direct and reflected waves under various relations of phase together with their resultants, which are represented by the heavy sine curves. In No. 1, where the waves are exactly opposed to one another, the resultant is zero, and this is represented on the screen by the wire when its curves are in the same plane as the eye of the observer. The other four diagrams show a gradual increase in the resultant, until in No. 5 it is almost a maximum.

Nos. 6 and 7 are a representation of two ways in which the curves may be traced upon the film. In No. 6 the ordinates of the sine curve represent displacement of particles; the ordinates above $o\,x$ displacement to the right of the point of rest, and those below $o\,x$ displacement to the left. In this case, however, an allowance of half a wave length must be made in the position of the resultant, owing to the fact that right and left have interchanged places in the reflected wave. This point is beautifully shown upon the screen. In No. 7 the ordinates represent different degrees of rarefaction and condensation, which, not bearing the relations of right and left, are not disturbed by being reversed in the reflected wave. The displacement method, however, has the advantage of being more

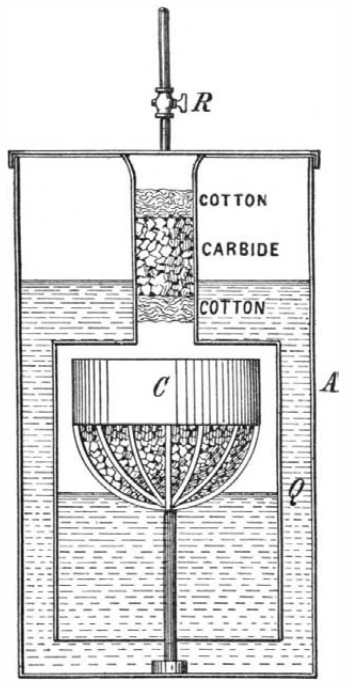


DIAGRAMS OF SOUND WAVES.

EDGE VIEW OF THE ENDLESS FILM.



SOUND WAVE LANTERN SLIDE.



SERPOLLET ACETYLENE GENERATOR.

realistic and definite, as in this case the transverse displacement in the sine curve corresponds exactly to the longitudinal displacement of air particles in sound waves.

SERPOLLET ACETYLENE GENERATOR.

A new form of acetylene generator has been invented in France by Messrs. Letang and Serpollet, in which a constant and regular production is aimed at, the supply ceasing when the gas is not used. The inventors have obtained good results with this apparatus in the lighting of cars and automobiles, and the Compagnie Générale des Omnibus have lately made trials of this system with reference to lighting the cars of the Louvre-Vincennes line. The carbide of calcium is treated by immersing it in petroleum for several weeks until it is well impregnated, and afterward giving it an exterior coating of glucose. The presence of the latter gives rise to the formation of a soluble organic salt of calcium, which facilitates the reaction and the proper disengagement of gas. The petroleum seems to protect the carbide from the action of the air. To this product the inventors have given the name of "acetylithe."

The generator consists of an outer cylinder, *A*, of tinned brass, filled with water to three-fourths of its height. To the bottom is fixed a basket-like receptacle, *C*, containing the carbide. The cylinder, *Q*, open at the bottom, is attached to the cover, and when lowered into the water causes the level to descend to a point below the recipient, *C*. If however, the cock, *R*, is opened, this level rises, and the water reaches the carbide, causing an evolution of gas. Upon closing the cock, the pressure of the gas causes the water-level to redescend, and the production ceases. The upper part of the cylinder, *Q*, is narrowed, and contains a layer of untreated carbide between two layers of cotton, for cleaning and drying the gas. This apparatus, with a consumption of 3 kilogrammes of acetylithe, will generate one cubic meter of acetylene, which burns from 7 to 8 hours in the group of burners devised by the inventors, giving 200 candle power. In the cars of the Compagnie Générale, the tests have been made with five lamps with a total of 50 candle power, consuming 270 grammes of acetylithe per hour. Owing to the favorable results obtained in these tests, it is probable that this system will be used on several of the lines now in construction in view of the Exposition.

AMONG the photographic questions to be discussed at the meeting of the Congrès des Sociétés Savantes, which will be held at the Sorbonne this year, are the following: Orthochromatic photography; researches relating to photographic shutters; preparation of photographic surfaces having the fineness of collodion and albumen, and which may be employed in the same manner as the plates now in use; researches in development of plates, printing of different papers, toning, and other operations. This meeting promises to be an important one, and will doubtless bring out a number of interesting researches.

CANTILEVER CRANES.

BY WALDON FAWCETT.

The construction of the Nicaragua Canal, when it comes, will be prosecuted at an immense saving of time and money as a result of the employment of large traveling cantilever cranes. This is a certainty, by reason of the great benefits, from an economical standpoint, derived from the use of these huge machines in the construction of the Chicago drainage canal. No more eloquent testimonial of their efficacy could be cited than the fact that the contractors who utilized cranes of this type were the only ones who were enabled to complete their contracts on time, or who made money by the operation.

When the commission appointed to investigate the Nicaragua Canal project came to the question of construction, they unhesitatingly accepted, as a basis for their estimates, statements of costs covering those divisions of the Illinois waterway on which the cranes had been used. As the cantilever crane is a distinct step in advance of methods which by its introduction have been made obsolete, these ponderous machines are certain of introduction not only at the Isthmus but in all other canal work of any magnitude as well.

The excavation of artificial waterways is, however, but one of a long list of innovations which have been brought about by the introduction of these cranes and kindred types of machinery. They are more than labor-saving machines, and nothing which has been introduced in the industrial world in two decades has proved more thoroughly revolutionary in its influence. They are factors in the whole process of iron and steel manufacture, one may almost say from the moment the ore is taken from the ground until it passes from the manufacturer's hands as a completed locomotive or battleship.

The cantilever crane is the highest step in development of material-handling machinery, every step of which is marked by some distinct type of machine, valuable in its own particular way. Ordinarily, the march of progress along inventive lines absorbs in each new product all its less perfect predecessors, but in this instance the advance of inventive genius has left as each footprint a mechanical triumph of fully as great value and utility in its way as the cantilever crane itself. The whole series have been distinctively American inventions, and the industrial interests of this country are now reaping a natural benefit in the immense export business which has sprung up to all parts of Europe.

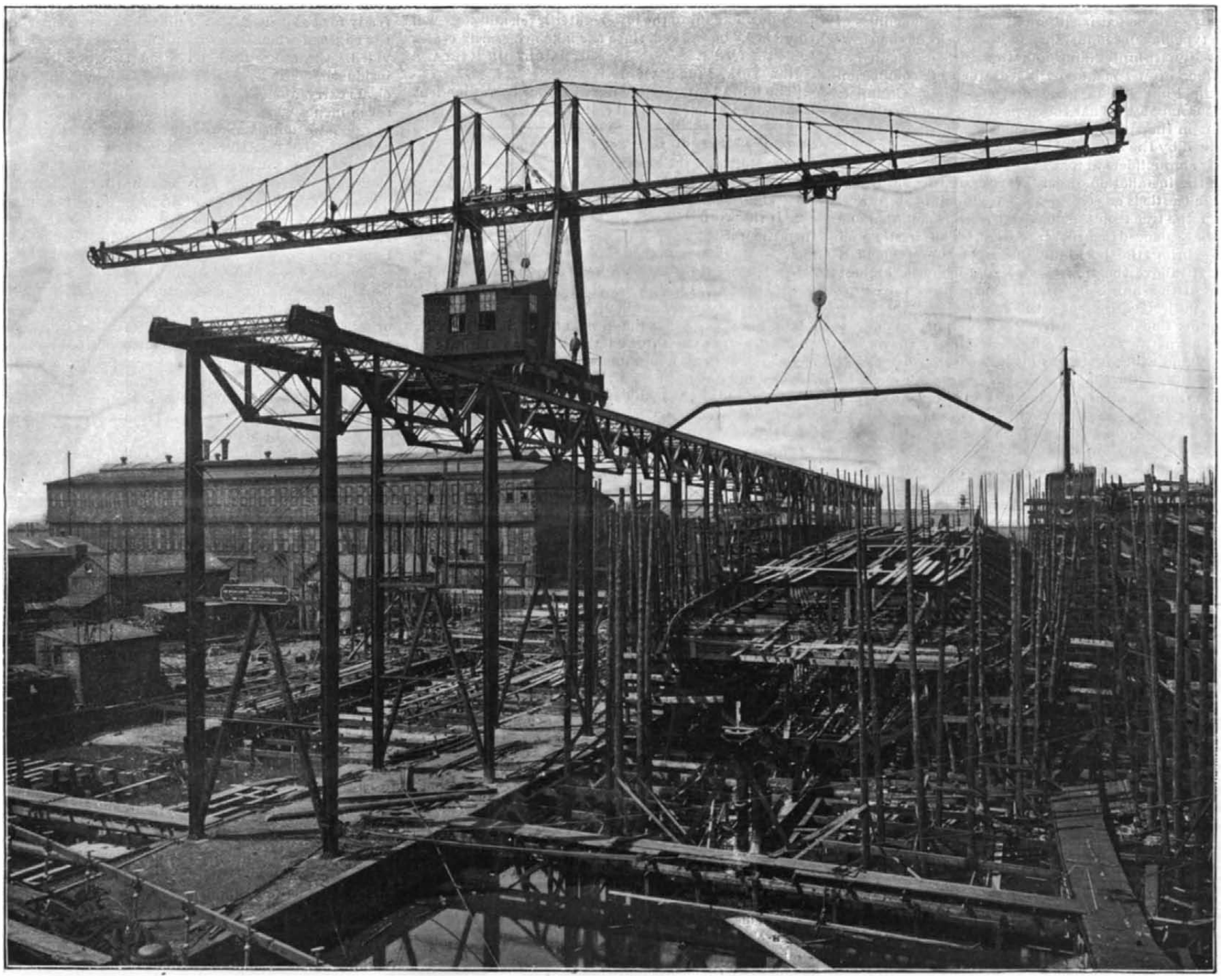
The idea of using rapid handling machinery for heavy materials of various kinds first came to Mr. Alexander E. Brown, C.E., along in the early 80's, and originally found expression in 1882 or 1883 in the invention of a movable bridge tramway, for hoisting and conveying bulk material of every kind, coal, ore, earth, etc., from vessels, mines and other places, and transferring the commodity, whatever it might be, to piers, warehouses, stock piles, cars, vessels and other localities. The machine has passed through many transitions since that time, but the distinctive elements have remained the same as at the outset; the elevated tramway, spanning the dumping ground, and connecting it with the vessel, cars, or other transportation vehicle, the trolley or carriage, traversing the same, and the system of mechanism by which the whole is operated and controlled.

When the first machines were erected on the docks at a port on Lake Erie the prospective purchasers stood aghast at the price demanded. Then the manufacturers made a daring proposition; they offered to install the machines with the understanding that they should be paid for only when the savings from the old system of transfer by means of wheelbarrows had reached in the aggregate the price demanded. The machines paid for themselves in a single season. Then came a mad rush to install the wonderful new apparatus, and now, on the south shore of Lake Erie, where are located the greatest ore unloading ports in the world, upward of two hundred of these machines may be found.

By the employment of this system material may be distributed over a dock from 300 to 400 feet in depth. In the tramway for unloading vessels herewith illustrated, for instance, there is a clear span of 180 feet; a cantilever extension of 92 feet, and a hinged projection which hangs over the vessel to the extent of 34 feet. The huge iron buckets which traverse these tramways each hold a ton and a half of ore; they are hoisted out of the holds of vessels or lowered back at the rate of about 450 feet per minute, and seeing that they travel along the tramway at fully as great a speed, it may readily be seen that a machine will handle fully forty tons of material per hour.

With the first radical step, which the installation of these machines constituted, successfully taken, the development of cantilever machinery went forward with rapid strides. The cantilever crane proper, the advent of which came but a few years later than that of the machinery just described, is probably used for a wider range of work than any other form of machine in existence. In scope it ranges from the great machines with arms extending over 350 feet, which were in use in the construction of the Chicago drainage canal, to the pygmy affairs used on tidal rivers and dock fronts, the arms of which are barely long enough to reach over a boat on the water side and over a single railroad track on shore.

In many of its features the cantilever crane em-



ELECTRIC, BALANCED, CANTILEVER, SHIPBUILDING CRANE, AS USED AT THE NEWPORT NEWS AND THE CRAMP YARDS.

Length, 187 feet; length of runway, 725 feet; height under boom, 100 feet.

bodies the qualifications of an ordinary swinging derrick, and indeed the principal difference is found in the fact that the boom or cantilever forms a track for a light carriage, thus obviating the necessity of swinging the entire structure, including house and machinery, over a large arc. In moving a piece of material the apparatus is placed in a position which will bring one end over the load to be transported, then the weight is hoisted and moved along the cantilever to its other end, which has meanwhile been pointed over the place of discharge by means of the movement of the whole structure along the track on which it is stationed. The great economy of the apparatus will be appreciated when it is explained that the entire operation of hoisting, carrying, swinging and lowering is conducted by one man in one position, each movement being independent of the other.

The principal uses of the cantilever aside from its employment in the loading and unloading of vessels is in the handling of material from large excavations, open pit mine work, the transference of frames, plates, and armor in shipbuilding yards, and the movement of heavy work of any kind in steel plants. In cranes,

where the entire structure is moved on a track parallel to the work, as on canal work and in shipbuilding yards, the swinging movement of the arms is often dispensed with, as all points are reached by the extended arms and the travel on the tracks.

For various reasons exceptional interest attaches to the great cantilever cranes which were manufactured by the Brown Hoisting and Conveying Machine Company, of Cleveland, for use in the construction of the Chicago drainage canal. These monster cantilevers had a length of 353 feet, and by their use rock was hoisted from the bottom of a channel 36 feet in depth to the top of a spoil bank 80 feet high. Each of the buckets which traveled on the cantilever had a capacity of three and a half tons of solid rock. They were loaded by hand, and with such rapidity was the work carried on that in one day a single machine transferred 510 loads, aggregating almost 900 cubic yards of material. Most wonderful of all, however, was the movement of an entire cantilever along its track at the rate of 300 feet per minute.

As has already been stated, one of the industrial fields wherein the cantilever crane is coming to be most highly appreciated is shipbuilding. Five machines of this type have been installed at the works of the Newport News Shipbuilding and Dry Dock Company, at Newport News, Va., and three are nearing completion at the Philadelphia plant of the William Cramp & Sons Company. That they constitute a most valuable agent in the speedy construction of armored vessels is attested by the extent to which they are being adopted by shipbuilders abroad.

In the installation of cantilever cranes in shipyards a high trestle is erected between each pair of shipways. Upon the track on top of each trestle is mounted one of the balanced cantilever cranes. The trestle and crane bring the horizontal boom of the crane high enough above the shipways to pass over the highest point of the ships being built. The arms of the cantilever project entirely over the full width of the ships on either side of the trestle. As the crane travels up and down the trestle by its own power, the entire length and width of both ships are covered by the extent of its motions, and materials can be delivered to any part of the ships being built. An assistant always travels with the crane to handle and guide the plates, or to hook them on as they are placed on the platform of the pier.

Steam power was originally utilized for the operation of cantilever cranes, but lately it has been almost totally displaced by electricity. On some of the cranes, of latest construction, the trolley will attain practically any speed desired on the tramway, while the speed of cranes on the track has now reached a point above 750 feet per minute. The size of loads which may be carried at different distances from the center of the crane varies greatly. For instance, whereas 28,000 pounds may be carried 55 feet from the center, it would hardly be safe to place a load of more than 9,000 pounds 89 feet from the center on the same crane.

One of the most interesting installations of cranes in America is found in the plant of four machines for handling ore at the Duquesne furnaces of the Carnegie Steel Company. These are in reality huge traveling cranes, although by reason of their cantilever extension they are amenable to inclusion in the general classification. The capacity is seven tons and the cranes have a clear span of 236 feet. They are utilized for the transference of iron ore direct from the stock piles to the furnaces.

There can be no question but that the powerful type crane is yet far from the climax of its development. The rapidly increasing demand for machinery of this type will compel greater perfection, and the introduction of electrical power and other innovations suggest that there is a possibility of future development.

Trade with Japan.

Japanese imports are rapidly decreasing under her new tariff, which went into effect at the beginning of 1899, while her exports continue increasing. The total imports of Japan during the first seven months of 1899 were 111,531,744 yen, against 177,074,378 yen for the corresponding months of the previous year, while the exports at the same time were 106,770,121 yen, against 82,188,791 yen in the corresponding months of the previous year, so that while her exports have increased 25 per cent, her imports have decreased. This marked reduction in Japanese imports suggests an inquiry as to how great an effect it is having upon her purchases from the United States. An examination of our own exports to Japan, made during the seven months covered by the Japanese figures, shows a reduction of only 18·2 per cent in our sales to Japan, against 37 per cent in those of the world at large, as shown by her own statement of imports.

It is said that there are over 2,000,000 golf balls used each year in the United States, American players being particularly prodigal in their use. The majority of the golf balls come from England. They are very difficult to manufacture, slight differences in the composition interfering with their usefulness.

Correspondence.

Regulation of Nicaragua Canal Summit Level.

To the Editor of the Scientific American:

I am not an engineer, and I trust you will pardon me for asking you a question which is perhaps absurd.

I see in the Nicaragua Canal scheme that the Lake of Nicaragua is to be the most important factor, not only as being a large part (about one-third) of the whole canal, but as the feeder of both branches of the canal proper, starting from the eastern and western shores of the lake.

The lake therefore is to be the summit of the canal.

In Nicaragua the year is divided into two seasons, the rainy and the dry. In very severe rainy seasons the lake rises considerably above its normal level, and in very severe dry seasons the reverse takes place, and the level of the lake falls sometimes several feet.

Leaving out the rainy season hypothesis, please tell me what sort of locks will have to be used in case of a considerable falling off of the level of the lake, first to bring up the vessels to the brink of the lake and then down again to the lower water level, and how will those locks be worked, since the lake necessarily ceases to be the feeder. Joly de Sabla.

New York, January 12, 1900.

[The important question raised by our correspondent is discussed in our editorial columns.—Ed.]

Use of the Term "Knots."

To the Editor of the Scientific American:

1. Referring to the speed of a vessel, is it proper to say "eight knots" or "eight knots an hour"?

2. If the word "knot" indicates a measure of speed, then the words "an hour" are superfluous, and incorrect.

If it is a measure of distance, 6,080 feet, then, in referring to the speed of a vessel, it should always be followed by the words "an hour."

The knots on a log line are 50 feet 8 inches apart, and when running through the hand at the rate of eight knots in half a minute, represent a speed of eight nautical miles per hour.

Quoting from Webster's Dictionary: "When a vessel goes eight miles an hour, she is to go 'eight knots.'"

Quoting from your January 20th issue, page 35: "Covering 3,077 knots in 5 days and 16 hours;" "speed per hour of 22·63 knots;" "speed of 34·8 knots an hour;" "rate of 35·5 knots;" "made 35 knots an hour;" "add another knot or more to her speed."

I have always looked upon your paper as authority upon such terms, and the above quotations puzzled me. Ernst A. V. Kendall.

382 Park Street, Hartford, Conn., January 29, 1900.

[The questions of our correspondent are answered in our editorial columns.—Ed.]

Preserving the Eyesight of School Children.

To the Editor of the Scientific American:

As a parent, and high school principal, I am thankful you have opened the discussion of the defective eyesight of school children.

One cause, which I have not seen emphasized, and which in my opinion has much to do with the matter, is the position of the book on the desk.

A lady in the Post Office Department in Washington lately said: "I have ruined my eyes in copying from books and papers, in a horizontal position." This is almost the exact position of school books on the slightly inclined desk lids. In such position the eye has an oblique instead of direct vision of the printed page.

The remedy is simple; namely, the use of inexpensive easels or book-rests, with some suitable devices for holding the book wide open. Such appliances are to be found at the book and stationery stores, at trifling cost.

A Boston oculist once said that such a device would both save eyes and prevent round shoulders.

The fine high school building at Bridgeport, Conn., has easels attached to the desks that hold the book in proper position, with page parallel to the face of the student. Joseph Dana Bartley.

Haverhill, Mass.

Permanent Magnetic and Electro-magnetic Fields of Force for Lantern Work.

Students in physics are familiar with the methods employed in mapping out the "field of force" surrounding a magnet or a conductor through which a current of electricity is passing and the way in which such "fields" may be fixed upon paper. To those unfamiliar with the methods recommended for fixing or copying such curves, the following brief references may be of use: Ganot's "Physics." wax and hot plate; "Physical Laboratory Practice," by Worthington; tannin is recommended to obtain permanent copies of the "field;" "Experimental Science," by George M. Hopkins; paraffine or spirit varnish is used. All these methods are serviceable in the laboratory, but in lecture work the "fields" are usually exhibited by means of a lantern. The above methods fail in lantern work, because the body usually used to hold the iron filings is either not transparent enough or is affected by changes in temperature. In the case of paraffine, great care must be exercised in handling the plate.

The object of this article is to describe a method by means of which the "fields" of force may be fixed upon a glass plate, after which the plate may be used as readily as the ordinary photographic slide. The plates employed for this purpose are those described in Nos. 642, 643 and 644 of the Scientific American Supplement of 1888. All finger and grease marks must be removed from the plates, and care should be taken that no lint or dust is upon them when they are about to be treated. Heat gelatine in a water bath until it is melted, and then add water until the compound is quite thin, stirring the while, so that the gelatine and water may be thoroughly mixed.

Some of the thinned gelatine is now poured upon the center of the glass plate; the plate is then tilted, first toward one edge, then another, until the gelatine covers the surface. The plate is now placed upon its edge and allowed to dry. The gelatine will set in from twenty to forty minutes, after which the plate is ready for the "field." A cubical tin or copper box, the edges of which measure nine inches, must be provided. Cleats are soldered upon two opposite faces inside the box, at four inches from its top. These cleats carry a shelf of white pine, nine inches long, seven inches wide, and one-half an inch thick. Strips of wood are nailed across the shelf, so that the glass plates to be treated rest upon two opposite edges. This box does not need a top, but must be watertight. Water is poured into this box until the bottom is covered to the depth of half an inch; it is then placed over a source of heat until the water which it contains is boiling violently, when the source of heat must be removed.

The prepared plate, with the field formed in the usual manner, is now placed upon the shelf within the box. The top of the box is now covered with a towel, or other absorbent body, so that drops of water, due to condensation, cannot fall upon the iron filings upon the plate. When the iron filings change from gray to black, the gelatine surface has softened sufficiently to fix the field. (This operation takes about one minute and a half.) The plate is then removed from the box and allowed to harden.

The above is a method devised five years ago, and the plates so treated at that time are as good to-day as they were when made. George R. Miller.

Lafayette College.

Sighting Smokeless Flashes.

Much has been said and written of late relative to the difficulty of locating the position of the Boers' guns, which are served with smokeless powder, except at night time. The flash of such explosion is practically invisible at the usual distance, the pale, mauve-tinted flame of each discharge being effectually stopped or masked by the yellow color of the sunshine or ordinary daylight. The flame color itself is chiefly due to the presence of metal potassium in the powder, and is powerfully marked when potassium picrate or nitrated gun-cotton, or trinitro-cellulose, subsequently treated with a solution of potassium nitrate, is an ingredient in the powder. Mr. W. Lascelles-Scott, an English chemist, has recently given considerable attention to the subject and states that such explosion-flames can be readily seen if care be taken to cut off all light proceeding from the red and yellow rays of the solar spectrum (and especially those of or near the so-called "D-line" of the sodium flame). This can be accomplished by looking through a piece of blue glass of a certain shade. The blue glass of commerce is of two kinds, but only the one colored by cobalt oxide is of any practical utility. It is of a blue-violet tint and a disk of it hung in front of a good field-glass will enable a smokeless powder flash to be easily located at the longest range. Hoffmann's violet and aniline color can also be used to tint a thin sheet of gelatine or mica. The front combination lenses of the field-glass can be removed and the posterior surface colored with the transparent dye and then replaced. The instrument will then show the invisible flash without the necessity of adjusting a separate piece of cobalt glass, and being inside, the film of color is not liable to be wiped off when cleaning the lenses.

The trustees of the New York Public Library say that $2,500,000 is not enough to build the library which the city ought to provide on the old reservoir site for the Astor, Lenox, and Tilden foundations. The reasons why a larger appropriation is necessary are that the cost of labor and building materials has increased 25 per cent to 30 per cent since the library plans were drawn. The constant accessions to the libraries make larger accommodations imperative. Since 1897, when the total was 461,945 volumes, the number has grown to 662,365 volumes. The number of readers has also increased from 103,384 to 501,092. Better systems of heating, lighting, and ventilation have also been perfected, and the new building promises to be a model of its kind.

Science Notes.

The Weather Bureau service is to be extended by the establishment of observatories in all Mexican Gulf ports between Tampico and Progreso. They will be under the charge of the weather officials at Galveston, Texas.

It is probable that barbed wire will become classed as war material, as it was largely used by the Spanish army in Cuba, and it is now doing excellent service for the Boers, and probably nothing tends to demoralize an assault more than strong barbed wire.

The Superintendent of the White Pass and Yukon Railroad took the snowfall at various points along the line of the railroad for December, with the following results: Glacier, 90½ inches; White Pass, 55 inches; Fraser, 42½ inches; Log Cabin, 74½ inches.

During a public exhibition of the properties of liquid air in a church at Ann Arbor, Mich., Prof. P. C. Freer was injured painfully. He dropped some ether in the test tube of liquid, and a violent explosion resulted. The liquid air was obtained from a new plant presented to the University by C. F. Brush, of Cleveland, Ohio.

In St. Martin's town hall, London, an exhibition of relics of Livingstone was recently opened. The extreme modesty of David Livingstone rendered the gathering of these mementoes of the great explorer very difficult. One of the principal objects of the exhibition is to put before travelers, or residents of unhealthy districts, specimens of appropriate articles of outfit which are likely to assist in the preservation of health.

The Passion Play at Oberammergau will begin on May 24, and there will be two performances in May, six in June, six in July, seven in August, and six in September. A covered auditorium capable of holding 4,000 persons has been built at a cost of $50,000. Oberammergau can be reached by the railroad, and the hotel and boarding accommodations will be vastly improved. It is doubtful, however, if Oberammergau will ever be the point of interest again that it was in 1880 and 1890.

An aquarium tank has been provided for birds at the New York Zoological Park, for the use of the Florida snake birds or darters. The tank is 9 feet long, 5 feet wide and 4 feet deep. The birds like to swim near the surface of the water, exposing only their long, wriggling necks. The bird lives chiefly on live fish, which it obtains by diving and catching them by a sudden movement of its long neck. Live fish will be placed in the aquarium, and the darter will be allowed to chase and capture its prey.

The London Lancet severely criticises the poor arrangements for removing to hospitals people who may be injured or attacked by illness in the streets of cities in Great Britain, and pays a well-merited tribute to the excellence of the ambulance service in American cities. It is probable that no city in the world has such inadequate provision for dealing with accidents as London. The victims are usually helped into a cab with the aid of a policeman and driven to the hospital, often resulting in a compound instead of a simple fracture. Hand stretchers are in frequent requisition.

The Supervising Surgeon-General of the Marine Hospital Service reports that the greatest care must be exercised at Quarantine in the inspection of vessels, even though they may come from non-infected ports, as they may carry passengers, crews, stowaways or merchandise from plague-infected districts, and there is one form of the disease in which the victims are able to walk around, and thus might escape detection by ordinary inspection, but might become active agents in disseminating the plague in a more violent form. The present epidemic first appeared in 1893 at Tonkin and Hong Kong, and spread thence to the western hemisphere. The disease is contracted by inoculation through an external wound or abrasion, by respiration, and by introducing the germ into the stomach.

The light of an illuminated room depends materially upon the color and nature of the walls, or, strictly speaking, how strongly the light is reflected by the walls. The results of experiments have shown the following percentages:

Black velvet	0·4
Black cloth	1·2
Black paper	4·5
Dark blue	6·5
Dark green	10·1
Pale red	16·2
Dark yellow	20·0
Pale blue	30·0
Pale yellow	40·0
Pale green	46·5
Pale orange	54·8
Pale white	70·0
Mirror covering	92·0

It also makes a difference whether the paint is dull, or glossy as with varnish coatings. Incandescent gaslight being the cheapest source of light, this style of illumination, aside from mirrored walls, in conjunction with a white varnish coating for the walls, would be most advantageous for lighting up a room.—Süddeutsche Apotheker Zeitung.

Engineering Notes.

The Manhattan Railway, of New York, will extend its lines on the east side from One Hundred and Seventy-seventh Street to Bronx Park at Bedford Park station. This will be most valuable for the Botanical Garden and the New York Zoological Park.

Russia has made overtures for the supply of 3,000 freight cars and 200 dining cars for the Trans-Siberian Railway. It is stated that the Russian government contemplates the purchase of more than 20,000 cars. It is also said that as many as 6,000 freight cars of many varieties will be needed in France owing to the Exposition.

The Kars-Erzeroum Railway represents a concession Russia is asking from the Sultan of Turkey, as an offset to the German concession recently granted for the railway to the mouth of the Euphrates. Kars-Ezeroum is controlled by Russia, and the 150 miles of railway would open up a commercial route of considerable importance now served by canals and pack animals.

The proposed Cape Cod Canal has recently come into notice, and figures have been presented before the Harbor and Land Commissioners by the engineers of the company. The canal would be without locks. The maximum velocity of the current through the canal would be four miles an hour, and possibly five in storms. The entrance width at Barnstable was fixed at 1,000 feet.

During the year just ended $150,000,000 has been expended for building improvements in Greater New York. There was a considerable rush to file plans before the new building code went into operation. A rapid rise in the price of land and building materials has caused many builders to enlarge the structures to the utmost limit in order to secure sufficient rental to make the buildings paying investments.

Steel ties on the Mexican Southern Railway have given great satisfaction, and they will be adopted by the entire line, 228 miles long. According to The Railway Review, these ties have been used for eight years on 141 miles of the line. They are of pressed steel and are 5 feet 5 inches long, the track being 3 feet gage, and the weight of the rail 50 pounds per yard. The tie is an inverted trough with flaring sides. The rail fastening consists of a U-bolt passing up through the tie from underneath the clips. Steel ties are not used on bridges or at switches nor around shops and roundhouses. Before laying, the ties are coated heavily with tar to prevent oxidation.

The old Arlington copper mine near Newark, N. J., has been sold and operations will shortly be resumed. Work was discontinued forty years ago, on account of the water in the tunnels and because the facilities at hand then made the work unprofitable. Now, owing to the rise in the price of copper, ores can be worked which would formerly have proved unprofitable. Powerful pumps were put to work about six weeks ago, and the deepest shaft, which was 240 feet deep, has been pumped out so that the men can work in it. The mine is of considerable historic importance. It was worked in 1720 by Henry Schuyler, 80,000 tons having been shipped from the property.

Metal culverts have been used with much success on the Congo Railway, of Africa, and are very useful owing to the fact that masonry is expensive in Africa, says The American Exporter. Steel tubes were used and they were 19·7 inches and 39·3 inches in diameter, and were supplied in lengths of 23·6 inches and 31·5 inches. They were formed of mild sheet steel varying in diameter from 0·15 to 0·35 of an inch. They were riveted together and made to taper slightly and the sizes were so adjusted that three lengths always fitted one within the other for the sake of saving in freight, Each end is fitted with a hoop to insure a good joint. First the tubes were jointed with Portland cement. Subsequently joints of tow and lead were used instead, but latterly all jointing has been dispensed with, as the earth soon washes into the interstices between the tubes and becomes consolidated. The objections as to want of durability urged against this mode of forming the culverts have not been established in practice.

At the New York meeting of the American Society of Mechanical Engineers, Paul M. Chamberlain read a paper on a curved glass blue-print machine. The glass is curved to a radius of 13 feet. Attached to one end of the frame is a sheet of canvas rubber packing $\frac{1}{32}$ of an inch thick. The other end of the rubber cloth is fastened to a steel tube, which serves as a roller upon which to wind the cloth, and also as a stretcher. The rubber cloth is rolled back on the steel tube, and the paper and tracing are placed on the convex side of the glass. The cloth, is unrolled at one end with one hand, leaving the other free to adjust or turn down crumpled edges of the tracing. The ends of the steel roller are engaged by cams so that a turn of the handle stretches the cloth, giving sufficient pressure. The frame is then turned over, and the car is pushed out of the window and adjusted so that it will receive the rays of the sun. The contact between the glass and the paper is excellent and the rays of the sun are received directly.

Electrical Notes.

The royal vaults under the Albert Memorial Chapel at Windsor Castle have been lighted by electricity.

A new hydraulic plant has just been completed at Laxey, on the Isle of Man, for working the electrical railway between Douglas and Ramsey during the winter months. This will enable the steam plant to be shut down about seven months in the year.

The Roentgen rays are proving their value in field surgery in South Africa. A fresh equipment of apparatus has been ordered, and skilled operators are being sent to the front. The Marconi system of wireless telegraphy is being placed on three British vessels which are intended for active service.

A new tunnel which is being constructed in Paris, for one of the electric roads, will be lighted by lamps turned on automatically as the trains enter the tunnel and be cut off automatically as the trains leave it. The lights have been placed on each side of the tunnel on a level with the windows of the cars, so that during the daytime it will not be necessary to use the lights in the cars.

A curious accident recently occurred at Quebec which resulted in the fatal injury of a man. According to The Western Electrician, he was pressing ashes into a cylinder, holding in his hand a long iron rod; the rod in some way met with an obstruction, causing him to raise it up quickly, thus breaking a globe of an arc light which was over his head, and so forming a circuit by which the current passed down into his body, resulting in his death.

Two proposed sites for the standard magnetic observatory in the vicinity of Washington have been examined during December by magnetic parties, says Science, under Dr. Bauer's direction, in order to determine the most suitable place. One of these sites, situated twenty-two miles to the northwest of Washington, has revealed pronounced magnetic anomalies, while the other site, sixteen miles to the southeast of Washington, has shown, thus far, no abnormal values. The latter site is also a favorable one to all appearances as far as freedom from electric railway influence is concerned.

The Chicago Union Traction Company will in a short time inaugurate a buffet service on the street and elevated cars. The arrangement will be similar to that between the Pullman Company and the railroads. The cars will be run as trailers at stated intervals, and an extra fare of five cents will be charged for the privilege of riding on them. Luncheon, coffee, cigars and liquors may be obtained on the car. When the long distances traversed by some of these lines are considered, it will be seen that a scheme of this kind is perfectly feasible and might also be adopted with advantage in New York.

The new telephone switchboards where electric lights are used for signals are giving great satisfaction. If the call is not answered, by hanging up the receiver and taking it off the hook and replacing it a number of times, the light will be caused to flicker, so that the attention of the operator will be at once directed to it, and the monitor will also see it and find out why the call is not answered. Many persons believe that when they ring the telephone continously they are inflicting aural torture upon the telephone operator. This is not the case, as a single turn of the crank releases the detent which controls the drop, and continuous ringing is of no value.

Nearly two hundred skilled telegraph operators from the British Post-Telegraph Department have gone to the seat of war in South Africa, and have been rendering splendid service. The Wheatstone automatic system is used on the field of battle, and probably for the first time in the history of warfare. It was worked duplex. Telegraphers were under fire for a whole day at Modder River, and still sent their messages. Both official dispatches and press messages numbering 100,000 words were sent at this time. After the Magersfontein battle the operator sent dispatches at the rate of 200 words per minute, according to The New York Sun, from which we derive our information. A tape, of course, was prepared by punchers in advance.

The Paris Exposition will be brilliantly illuminated at night. There will be 3116 incandescent lamps at the great entrance gate in addition to twelve very large arc lights; on the cupola and minarets there will be eight search lights, and sixteen simple reflector lights upon the pylons. The Alexander III. bridge will be lighted by 508 incandescent lamps of 117 candle power. The Electricity building will be lighted by 5,000 incandescent lamps, 8 search lights and 4 plain arc projectors. On the water palace there will be 1098 incandescent lamps. In all, says The Electrical Review, there will be 12,554 lights. These will only light the buildings as far as the Exposition authorities are concerned. Private individuals, corporations, etc., will, of course, require many thousand lamps for lighting their exhibits. There will be 174 arc lights on the Champs Elysées.

HALF A CENTURY IN THE DEVELOPMENT OF THE BICYCLE.

One of the best exhibits at the recent bicycle and automobile display at the Madison Square Garden, New York, was a valuable collection of historic bicycles, illustrating the growth of the machine from 1850 to 1900. The accompanying photographs represent the exhibit as it was arranged on the stand of the American Bicycle Company, to whom considerable credit is due for a display which was as unique as it was interesting and valuable.

Commencing at the left was the father of the present bicycle, the hobby horse. It was a popular form of amusement from early in the century to the year 1866 when cranks were first applied to the front wheel. According to the exhibitors, the hobby horse was really introduced in the year 1790, and for about thirty years was used with a stationary front wheel in which condition, like Mark Twain's Jerusalem donkey, it was incapable of any movement except in a straight line. About the year 1818 the front wheel was placed in a fork which was capable of rotary movement in the front end of the backbone; this is the type shown at the exhibition.

The next machine, a "velocipede," bears date 1870. The wheels are of unequal size, the larger, or driving-wheel, being in front and operated by cranks and pedals. The backbone is about one inch in diameter and solid. The saddle is fixed to a long, flexible spring which reaches from the steering head to a pair of rear forks, which extend upwardly to meet it from the hub of the rear wheel. The long projecting bar in front was used as a foot rest, the two laterally projecting rests on which the feet were placed having disappeared from this machine.

The next machine, also dated 1870, is a velocipede, on which are seen the curious weighted pedals which were arranged with balance-weights beneath them, to insure that the pedals should be always in the right position to receive the feet. The long saddle-spring of the last machine is replaced by a shorter, curved spring, which turns in to rest upon the backbone below the saddle.

Adjoining this is a "Wooden Ordinary" of the year 1875, which represents a transition between the velocipede and the high wheel on the other side of it. It is a home-made affair, with a wooden backbone stiffened by a strip of iron riveted on its under side. The rear wheel is reduced to the small dimensions which were characteristic some years afterward of the "Ordinary" type. The front forks are made of five-eighths-inch square iron and solid. The wheels, like the wheels of its predecessors, are of the buggy type with iron tires.

The machine bearing date 1878 is a good representative of the regular ordinary bicycle as used first in this country. It was the first product of the Pope Manufacturing Company, who have been so closely identified with the history of the bicycle in the United States. It has plain bearings, adjusted with jib and cottar. There is a roller brake on the back wheel, operated by a leathern thong, which is carried up the backbone and tightened by turning the handle bar in its bearings. The front and back forks are solid, while the backbone is hollow. These machines mark an enormous advance in the comfort of the rider, being fitted with rubber tires carried in half-round hollow iron rims.

Of the next model, the "Ordinary" of the year 1882, the exhibitors state that it contains all the improvements ever made in the high bicycle, the only subsequent modification being in the direction of a slight reduction of the weight. The forks, both front and rear, are hollow, as is the backbone. Ball bearings are fitted throughout, and in every respect the machine represents the high-water mark of the development of the wheel of the "Ordinary" type.

The machine of 1883, which was put upon the market when the "Ordinary" was in its heyday of popularity, represents an effort to provide a "safe" machine. It possesses most of the distinctive, and all of the essential, features of the tricycle of that day.

The next machine, which is known as the "Star Ordinary," was designed to overcome the dangerous elements of the high wheel bicycle. Owing to the fact that the center of gravity of the rider on an ordinary was dangerously near to the center of the front wheel, he was in constant danger of taking a "header;" and fatal accidents were only too common from this cause. The "Star Ordinary" was designed to overcome this objection and between the years 1884 to 1887, it was a strong competitor with the rear-driven safety for popular favor. The adjoining machine, dated 1884, represents the first rear-driven chain safety in this country. It was built and patented by George W. Marble. While it was never regularly manufactured, great credit is due to the inventor as having built this machine four years before the safety made its appearance in any numbers.

Passing by the "Veloce" safety, 1888, which is fairly representative of the development of the safety type of that date, we come to the "Columbia" cushion tire and steering fork safety of 1889. In this celebrated and deservedly popular wheel, we see evidence of the careful finish and attention to detail and form which, from this time on, characterize bicycle construction. The cushion tire, although it provoked considerable discussion at the time, undoubtedly paved the way for the pneumatic tire.

The machine of 1890 is a "Hickory" safety, which testifies to the great effort which was being made at

1850 1870 1870 1875 1878 1882

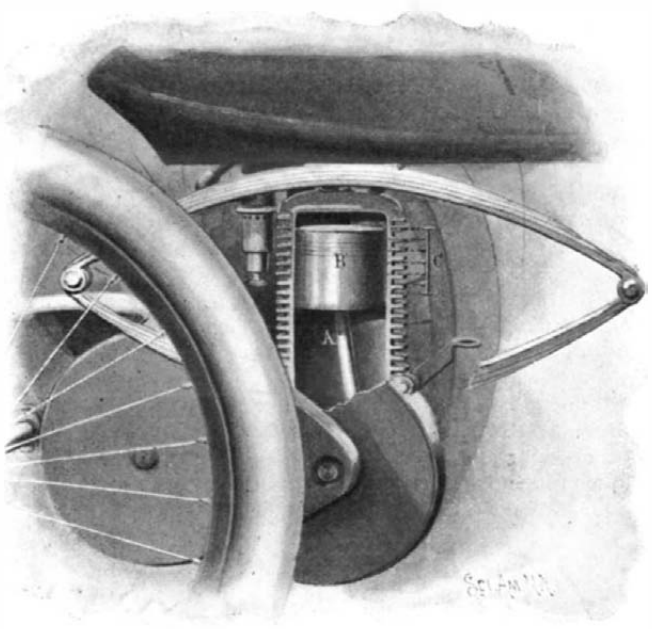
1883 1884 1884 1888

1889 1890 1891 1893 1896 1900

THE BICYCLE AND AUTOMOBILE SHOW—HALF A CENTURY IN THE DEVELOPMENT OF THE BICYCLE.

that time to reduce weight. Adjoining it is a machine which claims distinction on the ground that it carries the pneumatic Dunlop tires, with which it was equipped late in 1890. To riders of the present day it seems incredible that at its introduction the pneumatic should have met with decided opposition.

The "League" chainless of 1893, although it was



SECTIONAL VIEW OF LOOMIS MOTOR.

not an absolute success, is deserving of great credit as being the pioneer of its class, and as having demonstrated the practicability of applying bevel gearing to the propulsion of bicycles.

The next machine in this interesting exhibit is a typical chain-driven safety bicycle of the year 1896. It contains all the essential modern improvements of this type, including drawn tubing, wooden rims, divided axle and ball bearings on all wearing parts. The last machine, which is dated 1900, is supposed to represent the very acme of bicycle construction. It is a chainless machine of the Columbia bevel-gear type, with the low frame and light weight which are characteristic of up-to-date construction. As compared with the chainless of 1899, this machine is improved by the reduction of the weight from 28 and 30 to about 25 pounds.

Sorghum Sirup.

Despite the unusual opportunities offered by the sorghum-growing sections of the country, little has been done toward the production of a pure and acceptable table sirup. Of the 25,000.000 gallons annually produced, the larger portion is either consumed in the sorghum-growing districts or is mixed with glucose and sold under some coined name. Sorghum sirup is hence rarely quoted in commercial reports or found in great markets. The disrepute into which it has fallen is largely due to the inability of sorghum growers with their present inadequate and primitive machinery to produce a sirup of good quality.

The common method of crushing the cane in small mills, of evaporating the juice in shallow pans, and of removing the impurities merely by skimming, yields a sirup containing much undesirable vegetable matter, whereby its density is increased to such an extent that it is inferior to the juice of the sugar cane or beet.

The remedy is obvious enough. Sorghum juice must be clarified by processes which have been successfully used by refiners of sugar and makers of wine and cider, and not by the inefficient methods at present in use.

The possibilities of the sorghum industry are perhaps not fully realized. Sorghum is distributed over a wide area and thrives in the north and south, in the east and west. Minnesota's sorghum crops cover 3,000 acres; Louisiana's, 1,700; and Kansas can boast of plantations with an area of 1,000,000 acres, on which both saccharine and non-saccharine varieties are cultivated. The cane is produced at very low cost and flourishes in regions in which corn would perish.

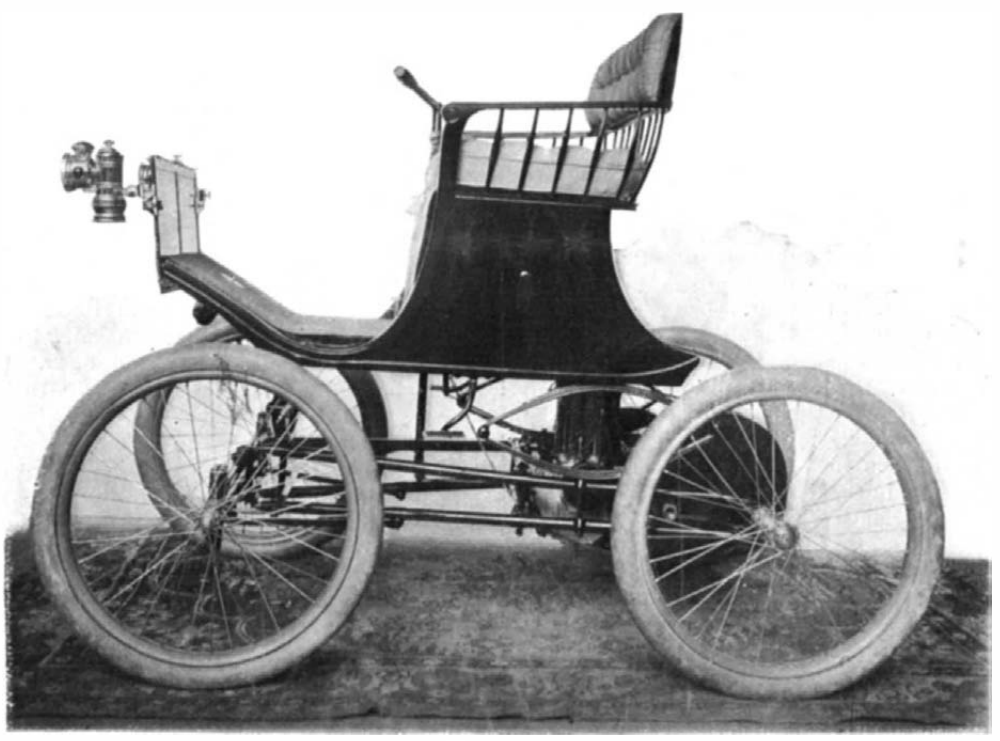
Sorghum of ordinary quality always contains enough crystallizable cane sugar and uncrystallizable glucose to yield a sirup of high quality. The cane is often exceedingly rich in saccharine matter. In Kansas sorghum is grown having an average of 12 to 14 per cent of sugar in the juice. In Louisiana the average is said to be 12 per cent; in the West Indies, 13 per cent; in Egypt, 14 per cent; in South America, 13 per cent; and in Java, 14 to 15 per cent. A ton of sorghum of ordinary quality with the aid of good machinery can be made to yield 20 gallons of pure sirup.

A sample of sirup sent to us from Kansas shows that sorghum juice, when well clarified, yields a clear table sirup of good color, good flavor, and good body.

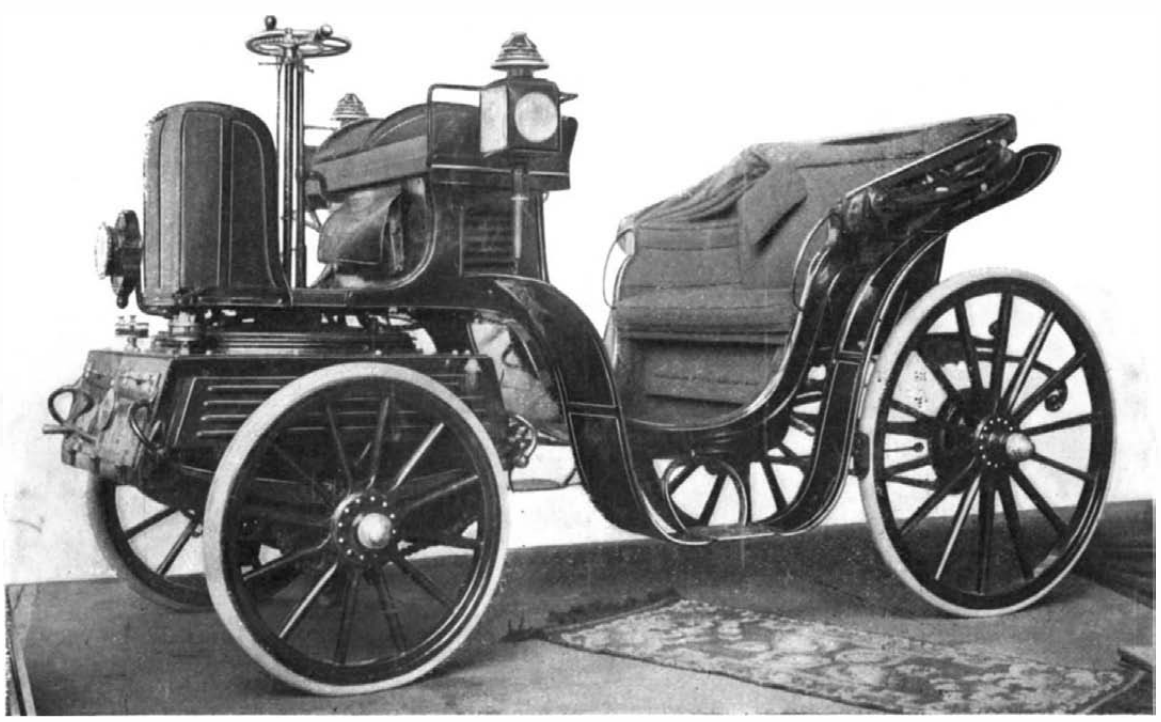
The waste products of sorghum are also not altogether valueless. A ton of cane yields at least two bushels of seed, which is worth from 25 to 75 cents per bushel. The crushed cane furnishes sufficient fuel for manufacturing the sirup, so that the treeless western sections of the country can produce the sirup at the same cost as other districts.

AUTOMOBILES AT THE MADISON SQUARE GARDEN SHOW.

The display of bicycles and bicycle appliances at the recent exhibition in Madison Square Garden, New York, was of a very high order. The exhibition, though smaller than its predecessors, was remarkable for the excellence of the workmanship in the machines that were shown and the complete absence of the freak devices which have disfigured previous exhibitions. There was very little in the bicycles themselves that was novel or marked a radical departure from previous models. It was natural that the novelties should be found in the more recent industry represented by the automobiles, and we have selected for illustration a few of the machines which attracted particular attention because of their originality in design and construction.

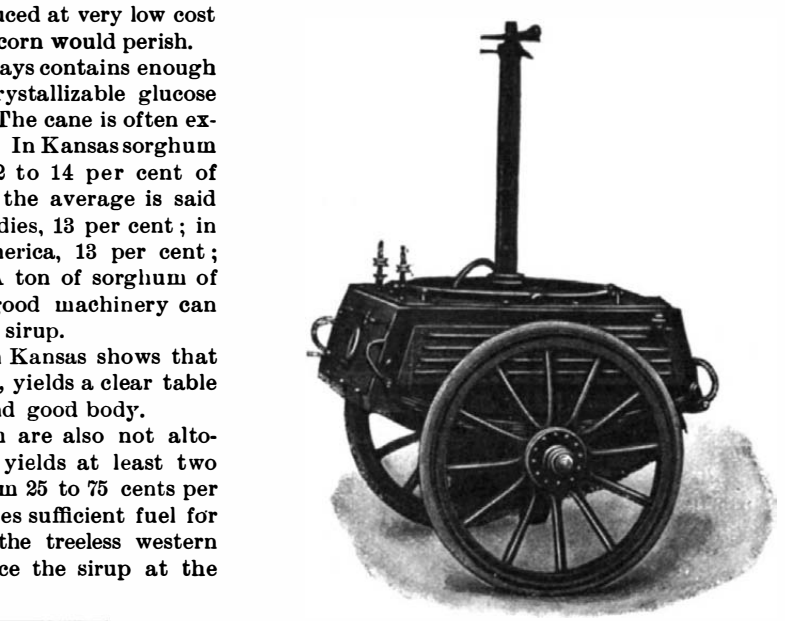


THE LOOMIS RUNABOUT.



THE BICYCLE AND AUTOMOBILE SHOW—THE AUTOMOBILE FORECARRIAGE.

THE AUTOMOBILE FORECARRIAGE.—Perhaps the most striking of these was a German motor made by the Automobile Forecarriage Company, which has been designed to enable carriage manufacturers or the owners of vehicles to convert their carriages into automobiles by detaching the front wheels and substituting these two-wheel motors in their place. The Vollmer Vorspann, to give it its German name, is nothing more nor less than a complete, self-contained, traction engine, which differs from the ordinary idea of a traction engine in the fact that instead of being linked up in front of its load and traveling on a separate wheel-base, it not only draws the load, but carries a portion of it on its own wheels. In our issue of January 6 we illustrated a motor-wheel which was intended to act in the same way and serve the same purpose. In that case the motor consisted of a single wheel, carried in strong forks, to which was bolted the two-cylinder gas engine, the oil tank and the other motor accessories. In the present case the tanks, engine, and gear are contained in a rectangular box or housing which is carried on a two-wheeled axle. Above the housing are two circular bearing-plates, the upper one of which may be bolted to the frame of the carriage, while the under one forms part of the housing. The two plates can turn one upon the other by means of a circle of rollers, and the lower plate has a circular rack formed upon it which is engaged by the pinion of the steering shaft, which shaft is carried by the upper plate and is placed conveniently to the right hand of the driver. The forecarriage motor is maintained in its proper vertical alignment by a strong, hollow, pivot-block, which extends upwardly from the lower bearing plate through a deep collar in which it turns in the upper plate. The whole construction is sufficiently stiff and strong to transmit the tractive effort of the motor to the body of the vehicle without racking the frame of the latter. The operating levers are carried up through the central pivot block, and are arranged conveniently in front of the driver.



THE FORECARRIAGE DETACHED.

The forecarriage may be operated by gasoline motors or by storage batteries as desired. The one shown in our illustration contains a four-cycle gasoline motor in which the vaporizing is automatically performed in a specially designed carbur-

eter. The gearing allows of variable speed, and the vehicle shown is capable of traveling at a speed of twenty miles an hour.

Loomis Automobile.—It was only a question of time—and the present exhibition has shown the time to be briefer than many people had hoped—when an effort would be made to put upon the market a small, light, and compact motor, whose price should be within the reach of the purse of the average person. We present two illustrations of a low-priced and compact little automobile which attracted favorable attention at the show. It is manufactured by the Loomis Automobile Company, of Westfield, Mass. The very neat and compact body is carried by means of four elliptical springs upon a strong seamless-tube frame, and the makers lay special emphasis upon the fact that the whole of the driving machinery is contained in a little box which is carried entirely by the frame and lies beneath and quite independent of the body, a method of construction which gets rid of a great deal of objectionable vibration. It is driven by a 2½ horse power gasoline motor, with flange-cooled cylinder, which may be operated at any speed from 1 to 15 miles per hour. There is no carbureter, a constant mixture being formed in an automatic mixer, the power and speed being regulated by varying the point of ignition with regard to the stroke, the ignition for full power taking place early in the stroke and for smaller powers at proportionately later intervals of the stroke. The ignition points are indicated by the small vertical lines at the side of the cylinder in the accompanying detail drawing of the motor. No water whatever is used, and hence the vehicle can be left in a cold barn without any danger of freezing in the winter time.

The motor is allowed to run when the vehicle is standing, otherwise it is necessary to start the engine by means of a hand crank, which is applied at the shaft seen through the rear wheel. A feature which will recommend these automobiles is the fact that the foot-board is entirely clear of steering or controlling levers, the steering being done by a lever which is placed on the outside of the body to the right of the driver, and the regulation of the power and speed by a button placed near the floor in front of the driver's seat. The total weight of this handsome little machine, ready for operation, is only 315 pounds.

The Invisibility of the Soldier.

The adaptation of color to the ground is one of the most interesting operations of nature, by which wild animals and insects are protected from destruction by their natural enemies. It has been amply demonstrated by naturalists that birds, reptiles, beasts, and insects are, so to speak, clothed in colors which strongly resemble those of the ground, herbage, or country in which they have their dwellings. This is called "protective coloration." Nature, which so carefully protects animal life from injury, teaches man a valuable lesson regarding the color of uniforms with which to equip soldiers when proceeding on active service in the field. In ancient days this was of little consequence, as when armor was worn the "dangerous zone" was limited to the effective range of weapons of offense of those days. With the introduction of firearms came a revolution in fighting. At first, however, the effective range of these weapons was also extremely limited, and some of them would carry no further than the bolts from a crossbow. In these early days the opposing armies were well within visual range before they fought each other. In time field artillery came into use, which also increased more and more the distances between the combatants. It was only the introduction of rifled artillery and rifled small arms which necessitated a decided revolution in tactics. Battles were now fought at greater distances and without the opposing armies necessarily coming into close contact with each other, though, of course, this contact does occasionally occur, as in assaults when bayonet charges are made, or in the days of old when the pikemen also made assaults. Blackwood's Edinburgh Magazine recently published a most interesting article on the invisibility of the soldier, by Lieut.-Col. C. H. Powell, of the First Goorkha Rifles, from which we condense the following: The great nations are now in possession of new magazine rifles of small caliber with a range up to 2,000 yards and over, and field and mountain artillery of a range of over 4,000 yards. Troops may be killed or put hors de combat at distances never thought to be within the bounds of possibility until the middle of the present century, so that it is evident that battles are now fought, or at least begun, at a distance far beyond visual range, so that fighting nowadays is very different from that which occurred even in the Franco-Prussian war, which proves the absolute necessity for dressing soldiers in a color which will make them as invisible as possible. The predominant uniform of the British army has always been scarlet, and no difference was made in the dress even in such a climate as India, where the troops sweltered under the tropical sun. Fortunately, it has become a recognized fact that scarlet should no longer be worn by troops in active service, as presenting too distinct a mark for the enemy's artillery and rifle fire. The authorities looked about for years before they found a fabric suitable in color and texture with which to clothe the troops for active service. A color has at last been found in the shape of "khaki," which name is derived from an Indian word for a particular dye. It is a dye of a yellowish hue, and has always been much used by the natives. The fabrics which have been colored in India were found to be inferior, owing to the fact that the color was not fast and became lighter with each successive washing, so that it was almost impossible to keep the uniforms of the men of the same shade. The result was that the regiments after a time presented a motley aspect and looked untidy. The Indian army was the first to adopt this color, and most of the native regiments had their own dyers. The color increased in popularity, and in time the military authorities in India decided to equip the British regiments with uniforms of this khaki color. At first it was only used for fatigue duties, but now it has entirely replaced white, even, for ordinary parades, the white uniforms being retained only for church parades and walking out. In 1884-85, two Englishmen, Messrs. Lemann and Gatti, were successful in discovering an absolutely fast dye, and the result has proved a benefit to the whole army, and it can be applied equally to woolen and cotton cloth. Lord Roberts, in 1885, took up the subject of khaki in an energetic manner and was easily convinced of the suitability of this color for uniforms in the field, and even went further. He issued an order to have the whole equipment of the field and mounted batteries, including even the wheels and guns themselves, painted khaki. The troops sent out to Egypt to take part in the reconquest of the Soudan, and now the army corps which are being dispatched to the Transvaal, have all been fitted out with khaki, including covers for their white helmets, haversacks, and water bottles. The leggings and the spats of the kilted regiments are all of khaki, and even their boots are an unblackened leather. The old days when soldiers spent hours of their time pipeclaying their belts are now passed, and, in fact, the fighting soldier of to-day presents a striking contrast to his predecessor of a century ago. Certain regiments in the service are allowed to retain a distinctive uniform; for instance, the Highland regiments adhere rigidly to their tartan kilts, which, being of a dark color, stand out in striking contrast on a veldt or mountain side. One of the Boers who was taken prisoner stated that the soldiers wearing kilts were very easily seen, but those wearing khaki were very difficult to locate. The kilt is not only picturesque, but is highly practical and sensible for campaigning in a mountainous country, but the color is against it and renders the men needlessly distinguishable. Sir Archibald Campbell has suggested a reversible kilt of tartan on one side and khaki on the other. This material would probably be very thick, so that it would hardly commend itself to the Highlander. The distinction between the various Highland clans does not seem necessary on the battlefield.

It is a lamentable fact that the percentage of killed and wounded officers in the several opening battles of the Transvaal war is very high, and this may, in many cases, be traced to the uniforms which the officers wear. It was one time considered necessary for the officer to be as differently dressed from his men as possible, so that the rank and file would be able to distinguish their leaders; but this idea seems to be more or less exploded, and very rightly so. The officer's voice is quite sufficient, and there is no excuse whatever for the men not recognizing their leader, no matter in what garb he is attired. The officer is a valuable factor and should be preserved, as far as circumstances will permit, from danger, and Lieut.-Col. Powell makes some practical suggestions regarding their equipment, in which he recommends that all parts of the uniform be made as inconspicuous as possible, even to belts, and suggests also that all the accouterments, wherever possible, be made of khaki. In days gone by the sword was doubtless a very useful weapon of offense as well as defense, but nowadays it is universally recognized that an officer would rely more on his revolver than his sword, and many officers are of the opinion that the sword belonging to them should be left behind when he goes into action. The sword is more of a decided encumbrance to an officer's free movement when moving on hilly ground, and as a matter of convenience he generally takes it out of his belt and uses it as a walking stick; and it is a very inferior one at best. Lieut.-Col. Powell recommends that they carry a small carbine, which will give the officer a useful weapon of offense should he find himself in a tight corner. Badges on the helmet should also be discarded, for as one writer has stated, they shine like a diamond in the African sun, and more than one officer has remarked that he would infinitely prefer carrying a good stick into action than a sword.

It is said that the Baldwin Locomotive Works have received an order from the French State Railways for the construction of ten passenger locomotives, which must be completed early in the summer.

To Renew and Clean Old Albumen Prints.

To renew and clean old albumen prints, a solution of bichloride of mercury more or less acidulated is used, which gives to the prints a fine purple color. M. Gabelle, in a communication to the Société Française de Photographie, has given the following formula:

Water	85 c. c.
Bichloride of mercury, saturated solution	10 c. c.
Hydrochloric acid	5 c. c.

These proportions, however, are not absolute. The hydrochloric acid is useful for sulphated prints upon collodion papers. The action of the bath is immediate, almost instantaneous, in fact, for certain papers, such as citrate of silver. It is slower for those papers whose surface layer is hard. As soon as the result is obtained, the print should be washed in several changes of water for an hour at least. All contact with hypo should be avoided, as this gives yellow stains which cannot be removed. The tones thus obtained vary from reddish to violet.

In the case of fresh prints, good purple tones may be obtained by this process, but they should have been previously toned in a solution which contains a certain proportion of old bath. M. Gabelle gives the following formulæ for use in this case:

Old used bath			750 grammes.
New bath	Alum	30 grammes	250 grammes.
	Hypo.	300 "	
	Acetate lead	1 "	
	Water	100 "	
Chloride of gold solution 1 per cent.			8 c. c.

Allow to stand for two days. Tone the proofs for a long time, say 20 to 30 minutes, and wash for 3 hours. After allowing to drip, they are immersed in the following bath:

Water	100 c. c.
Bichloride of mercury, saturated solution	5 c. c.

As soon as the desired tone is obtained, which should be in about one minute, remove and wash carefully for an hour and dry. This should be done by diffused light. Great cleanliness is recommended in this operation, and hypo stains are to be avoided.

Great Diamonds.

At least seventy diamonds are in existence which have a long and romantic history. The largest diamond in the world is the "Braganza," which weighs 1,680 carats in the rough. It was found in Brazil and is now in the Portuguese treasury. The finest and certainly the most famous diamonds in the world came from India. At the break-up of the empire of the Great Mogul, his treasures were scattered, and the "Koh-i-nur," "Orloff," and the "Moon of Mountains" came from this collection. The "Great Mogul" is now believed to be lost; it weighed 787½ carats and it has not been seen since 1665. It is possible that it has ceased to exist in its original state. The "Koh-i-nur," which now weighs 103½ carats, has a history which goes back to 1526, while tradition gives it a career of 5,000 years. It was seized in the Lahore jewel chest and was brought to England. In 1852 it was reduced from 186$\frac{1}{16}$ carats to its present weight. The "Orloff" diamond, which is the chief ornament in the imperial scepter of the Czar, is the largest diamond in Europe, weighing 193 carats. It formed one of the eyes of an idol. It was sold in Amsterdam for $450,000 and an annuity of $20,000 to Count Orloff. The "Moon of Mountains" is also among the Russian crown jewels. The gem of the French regalia was the famous "Pitt" diamond, which was found in the year 1701 and was reduced from 410 to 137 carats. It was bought by the Duke of Orleans in 1717 for $675,000. It has been valued at $2,400,000. One of the largest diamonds ever found was that picked up by a negress in Brazil, which is known as the "Star of the South," and weighs 254 carats. The "Star of South Africa," whose history we have already noted in a previous issue, begins the history of the rush for the diamond fields in South Africa. The English Illustrated Magazine, from which we glean our facts, recently had an article upon this subject illustrated by actual photographs of the diamonds.

A Constituent of Lyddite in Milk.

"Lyddite" is made by a secret process of the British government, but it is known to consist largely of melted picric acid. One of the best coloring matters used for the purpose of giving a rich appearance to milk and milk products is Martius yellow, known under various other names, such as naphthol-yellow, saffron yellow, etc. This substance is chemically dinitroalphanaphthol, which is prepared from naphthalene. According to The London Lancet, it is an important constituent in the making of lyddite. Martius yellow is slightly explosive when heated, but it is not dangerous on this account when used in milk. It is, however, considered as an injurious coloring matter and is liable to produce poisoning if it is brought into contact with an abrasion of the skin, thus taking away from its value for use as a tinctorial agent.

Can Ants Hear?

Whether ants can hear is a question which has engaged the attention of Mr. Weld, of Iowa University, for some time, and he has recently published an account of some of his experiments in Science. He states that for many years it has been the accepted opinion among naturalists that these insects are not endowed with an acoustic sense, at least within the range of sounds perceptible to the human ear. This opinion is based upon the failure of experiments which showed that loud and shrill noises do not produce the slightest effect upon ants. Mr. Weld, however, finds that this was not the case with several American species of these insects. He confined an ant in a test tube and brought it near a milled disk rotating in the air. At each sound which was produced, the ant showed unmistakable signs of agitation, quickly moving its head and antennæ. Shrill noises were produced close to a colony protected under a glass, and the ants immediately showed signs of alarm. These experiments lead to the conclusion that at least some species of ants are capable of perceiving vibrations conducted through the air or other media which are audible to the human ear. This does not necessarily demonstrate that they hear in the strict sense of the word, but merely that they are capable of perceiving ordinary sounds.

A REMARKABLE BANYAN TREE AT ST. KITTS.

In enumerating the remarkable examples of forest growth, the banyan tree (Ficus indica) would assume an honorable place. It is a native of several parts of the East Indies, Ceylon and some parts of the West Indies. It has a woody stem which soon divides into many branches. Every branch from the main body throws out its own roots, at first in small tender fibers several yards from the ground; but these continually grow thicker until they reach the ground when they strike in, and, after being nourished, increase to large trunks and become parent trees, shooting out new branches from the top, and the process is continued until the tree covers a considerable area. It is reported in authentic works that a banyan tree on the Nerbudda once covered a space so great that it sheltered 7,000 men. The power of the floods have now much reduced it in size, but it is still 2,000 feet in circumference, and the trunks, large and small, exceed 3,000 in number. Other trees have been known to cover an area of 13 acres. They are frequently found near temples, and on or near funeral mounds. The figs are insipid but abundant. The leaves are of a bright green and form a dense shade, they are 5 inches long and 4 inches wide, and they are used by the Brahmins as plates and dishes. The wood of the tree is porous and is almost worthless. The natives use various portions of the tree for medicinal purposes. The example we illustrate is on the island of St. Kitts, British West Indies.

A BANYAN TREE ON THE ISLAND OF ST. KITTS, BRITISH WEST INDIES.

Magnalium—Its Properties and Uses.*

Magnesium, it is well known, is a grayish white, soft metal of a certain toughness, which, physically, resembles aluminium. Its specific gravity is even smaller. Although it can be formed into wires and ribbons and rolled into sheets, it cannot readily be filed, turned, or cut. Chemically, however, it is not so resistant as aluminium. Polished surfaces of aluminium lose little or nothing in brightness when exposed to the air; but magnesium under similar conditions is soon covered with a skin of oxide. Dr. Ludwig Mach discovered that alloys of magnesium and aluminium possess properties not found in either of the two components. Woehler also made alloys of magnesium and aluminium by fusing together equivalent weights (in the proportion therefore 27·5 : 12) of the two metals and obtained a white, extremely brittle mass which ignited at red heat and burnt with a bright flame. By mixing four equivalent parts of magnesium with one equivalent of aluminium, a semi-malleable mass was obtained, which, owing probably to the presence of sodium chloride, decomposed in water after a few days without generating hydrogen. Later investigators, Parkinson, for example, have come to the conclusion that alloys of aluminium and magnesium have no practical value. Even Richards, in his work on aluminium published as late as 1890, forms the same conclusion.

The unsatisfactory results obtained by these physicists, according to Mach, are due to the use of impure metals, and to the lack of a systematic variation of the proportions employed. If pieces of magnesium be dissolved in molten aluminium by dipping them in the superheated mass with a porcelain rod, alloys will be obtained which differ widely in their mechanical properties, depending upon the quantity of magnesium originally employed. Alloys which for 100 parts of aluminium contain 10 to 30 parts by weight of magnesium are as a general rule ductile, vary in hardness between brass and bronze, and can be most readily worked with a file, on the lathe or rotary cutter. The specific gravity of these alloys varies between 2 and 2·5; whereas pure aluminium has a specific gravity of 2·7. Alloys thus obtained can be cast in thin liquids as readily as aluminium, and fill the mold fully as well; on the lathe they can be turned like brass into long, coiled strips. The surface becomes mirror-like in brightness and silvery in appearance. Screws can be cut cleanly to any pitch. Under the file the characteristic ring of brass or steel is heard. Even the teeth of the finest files are not clogged, at least not with those alloys containing from 25 to 30 per cent of magnesium and equaling bronze in hardness. Alloys containing from 10 to 15 per cent of magnesium can be turned, cut, rolled into sheets, and pulled into tubes and wire—all of which properties are possessed by aluminium. These alloys are furthermore capable of receiving a high polish; and the polished surfaces are distinguished by great resistance to atmospheric influence. They are whiter than aluminium or magnesium and are good light reflectors. For ordinary uses, where small weight, great tenacity, and strength are required, these alloys containing small percentages of magnesium are evidently extremely serviceable. Alloys in which the proportions are reversed, that is, those which contain little aluminium and much magnesium, have similar properties and smaller specific gravity, but are less beautiful in color. They are capable of resisting atmospheric influences and are of feeble strength. On exposure to the air they become spotted, and are corrosively acted upon by water and readily ignited in casting. When the oxide is not thoroughly removed and the mold is badly filled, the castings are not homogenous.

At present the cost of these alloys is considerably greater than that of pure aluminium, owing to the higher price of magnesium. But the question of cost cannot long affect the application of the alloy; for the new metal, measured by volume, is cheaper than brass. Moreover, magnesium is so expensive chiefly because it has been used only in small quantities and produced only on a small scale. When the metal will be more widely employed in the arts, it will probably become cheaper than aluminium: for it is manufactured from very inexpensive raw material and its reduction is attended with less difficulty than that of aluminium. We may, therefore, hope that Mach's alloy—"magnalium," as it has been called—will become one of the cheapest metals which we can use. The strength of the compound is extraordinary. Tests made by the inventor show that magnalium is stronger than cast iron and less brittle. On cross-section it is fine-grained, steel-like, and splits in several directions. The coarsely crystalline structure of pure aluminium or zinc is not present. Stampings of magnalium are produced with the same readiness as those of rolled brass. The alloys of aluminium and magnesium described contain from 10 to 30 per cent of magnesium. With an increase of magnesium there follows an additional hardness, brittleness and capability of receiving a high polish. Mach's investigations were made primarily for the purpose of discovering a metal particularly adapted for mirrors, great hardness being the prime requisite in order to obtain the desired reflecting surface.

The art of making metallic mirrors is by no means new. The ancients, it is well known, used them. In modern times amalgamated or silvered sheets of glass have been used for the ordinary purposes of life; for optical uses metallic mirrors have been employed. Up to the middle of the last century the achromatization of lenses was held to be an impossibility; and reflecting telescopes were therefore used in astronomy. Instead of the object glass now employed, these telescopes had a mirror of cast metal, ground in parabolic form. But the speculum metals hitherto used, although capable of being highly polished, have a specific gravity rarely below 8; their reflective power, moreover, is by no means equal to that of silver.

These defects, coupled with inability to withstand usage or exposure to the atmosphere, have rendered a new speculum compound almost a necessity. Magnalium offers all the advantages which have been hitherto lacking in ordinary speculum metals. For when it is composed of equal parts of aluminium and magnesium it is exceptionally hard, capable of receiving an exceedingly high polish, and above all of extraordinarily small specific gravity. The mechanical properties of alloys containing 1 part of aluminium and magnesium in proportions varying from 2 to 1 for the aluminium, and for 1 to 3·25 for magnesium, differ widely. The reflecting power of the alloy, especially when a minimum of aluminium is used, is fully equal to that of the best silver mirrors. The optical experiments made with magnalium mirrors by Dr. Victor Schumann, of Leipsic, lead to the conclusion that ultra-violet rays of the spectrum are better reflected by magnalium than by silvered glass; the same result holds good for the visible portion when certain alloys are employed.

Magnalium mirrors have preserved their reflecting power despite the chemical influence of the atmosphere. In this respect they are far superior to silver mirrors, which soon form sulphur compounds, and to steel mirrors, which oxidize so readily. The treatises which Mach and Schumann have written on this new metal fully describe its remarkable optical properties; of particular interest are those portions treating of the absorption of gases by the molten alloy, and the precautionary measures which Mach recommends to prevent this absorption.

* Translated from Prometheus.

Production of Caoutchouc in Brazil.

According to the report of the Belgian consul, the figure for the export of caoutchouc from Brazil for the crop of 1896–97 was 22,216 tons, of which 9,848 tons went to the United States and 12,368 tons to Europe. The production of caoutchouc in that country has increased rapidly during the last forty years. In 1860 there were but 2,400 tons exported. The following table shows the increase since 1881 and the distribution between the United States and Europe:

Year.	United States.	Europe.	Total.
1881–82.....	5,323	4,430	9,753
1886–87.....	7,346	6,004	13,350
1891–92.....	11,593	7,168	18,761
1896–97.....	9,848	12,368	22,216

The greater part of the caoutchouc exported to Europe goes to England; in the years 1896–97 this amounted to 10,331 tons upon a total of 12,368.

New Process of Wine Making.

A recently brought out although thoroughly tested process in the production of wine, and particularly of red wines, consists in subjecting the grapes to the action of heat and pressure instead of using them cold and allowing the juice to exude by the natural pressure of the mass, or by very slight artificial pressure for the first crus. The new process has for its result:

1. The solution of all the red coloring matter of the grape in its own juice, before fermentation.

2. The sterilization of the "must."

3. The production of wine of a quality superior to that of normal samples from the same grapes by the old methods.

The experiments which have led to the above results and conclusions were made on the vintages of 1897 and 1898, both in Tunis and in France. More than 100 tons of grapes were thus heated, at seven different observation stations. All the resulting wines, without exception, have been better than those from the same grapes under the traditional conditions.

Among other things, it has been shown by these experiments:

1. That the grapes thus heated for the purpose of dissolving the red coloring matter in the juice lose their resistance to pressure and hence give a greater yield of juice than the non-heated.

2. The juice extracted under the press has a richer color than that allowed to run out under natural or very slight artificial pressure.

3. The wine resulting from this fermentation has more color and more "body" also than that from the old process, which is reverse (without pressure) of what has always been observed in comparing the first and the last "crus" by the cold process.

4. The sterilization of the "must" obtained by heating permits the careful study of the effects of various kinds of ferments upon the same juice.

In this connection there have been employed experimentally ferments of various kinds, including those from some of the most celebrated high grade wines or "grands vins."

5. The tasters could detect no difference among the various wines produced from the same "must" by use of different ferments, so that no conclusion could be arrived at as to a choice of ferments. There was, however, a difference in the alcohol percentage. All the new process wines were richer in alcohol than those by the old method from the same grapes. But those made with "cultivated" ferments gave rather poorer results than those with the natural from the "grands crus."

6. In districts infected with the "tourne" disease, the wines made by the new process were the only ones which were exempt.

Intensification of Negatives.

Messrs. Lumière and Seyewetz have presented to the Société Française de Photographie a new method for reinforcing photographic plates by the use of iodide of mercury. The action of this reagent has been previously known, but on account of subsequent decomposition it could not be used in practice, the image becoming yellow after a time and diminishing in intensity. The experimenters propose to remedy this inconvenience, and for this they have first established the theory of the reaction, supposing that a solution of mercuric iodide in hyposulphite of soda results in the formation of a double salt, $HgI_2+2Na_2S_2O_3$. Under the influence of the silver of the plate, the mercuric iodide is reduced to mercurous iodide, with the formation at the same time of iodide of silver; in the second phase of the reaction, the mercurous iodide, in the presence of sodium hyposulphite, decomposes into metallic mercury and mercuric iodide, which latter redissolves in the hyposulphite.

The total reaction may be expressed by the formula: $2HgI_2+2Ag+2Na_2S_2O_3=2AgI+Hg+HgI_2.2Na_2S_2O_3$. The intensification of the plate is therefore due to the mixture of mercury and iodide of silver produced by the reaction. In this case the alteration of the image follows after a certain time, and much more rapidly when the plate is kept in water. It may be supposed that under the influence of moisture and oxygen the mercury forms with the iodide of silver a combination of a yellow color, perhaps HgO, AgI; the experiments made with the plate in its altered condition seem to confirm this hypothesis. In order to prevent this decomposition and to render the method practicable, the experimenters have transformed the iodide of silver into metallic silver; this is accomplished by using one of the photographic reducing agents. At the same time it was observed that the hypo could be advantageously replaced by sulphite of soda to dissolve the iodide of mercury. The method of reinforcement may be carried out with success as follows:

A bath is formed of 1 gramme iodide of mercury, 10 grammes sulphite of soda, and 100 c. c. water; the proportion of sulphite of soda may be varied within certain limits. The plate, after leaving the hypo, is rinsed and placed in the above bath; the image gradually takes a brown color, and the intensification may be stopped at any desired point. This image is not yet in a stable condition, and will take a yellow-green color upon exposure to air if not treated in the following manner: The image is fixed by a solution of one of the well-known reducing agents, such as pyro, hydrochinon, diamine, paramidophenol, etc. The iodide of silver is thus entirely transformed to metallic silver, the image then being free from iodine. In this condition the plate may be kept indefinitely with no danger of alteration. If it is desired to again reduce the image, it may be placed in a hypo bath, which dissolves out a portion of the iodide of silver; this must be done before the final reduction in the second bath.

The Current Supplement.

The current SUPPLEMENT, No. 1258, has many papers of unusual interest. "Two Famous Boer Guns" illustrate "Long Tom" and "Mrs. Smith." "The Gun-Cotton Problem" is an important article by Frederick H. McGahie, an expert on explosives. "The Manufacture of Coal Gas" is a fully illustrated article. "Kite Meteorograph Construction and Operation" is an article describing the latest kites and meteorological instruments used by the Weather Bureau in obtaining records, and is accompanied by several illustrations. "An Important Patent Decision" is by Arthur F. Kinnan. "Germany's Latest Battleship" describes the "Kaiser Friedrich III." and is accompanied by elaborate sectional views. The abstract of the report of the Committee on Canals of New York State is an important document accompanied by maps, profiles, diagrams and cross sections.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

COTTON-CHOPPER.—RICHARD W. KIRBY, Cookville, Tex. The working parts of this machine can be collectively raised and lowered to pass an obstruction. Scrapers are provided in advance of the choppers, adjustably mounted so that they regulate the depth of the cuts. Rollers are interposed between the choppers and the scrapers, which rollers are arranged to travel in the furrows formed by the scrapers, and thus cause the choppers to rise and fall according to the character of the ground. Cultivator-blades at the rear of the choppers are adapted to travel in the spaces between rows. A removable rake is located in advance of the scapers to clear chaff and stalks from the path of the scrapers.

HARVESTING-MACHINE.—WILLIAM L. WALTON, Neche, N. D. Since harvesters are usually required to work in soft ground, the ordinary master-wheel sinks from one to four inches into the soil, not only occasioning heavy draft, but seriously affecting the driving of the machinery, causing the master-wheel to slide in the loose ground. The inventor overcomes these difficulties by providing a master-wheel fully as effective as that heretofore used and capable of traveling upon soft and hard ground with equal facility. A simple driving mechanism is provided, operated from the master-wheel, which mechanism does not interfere with the raising and lowering of the elevator and connected parts.

CANE-HEADER.—WILLIAM D. EASLEY, Ringgold, Tex. In this device for cutting off the heads of cane, Kafir corn, or the like, a header-frame is provided, in which a cranked shaft is mounted. Gathering-fingers on the cranked portions of the shaft have a hinged connection with the frame at their rear ends. Stripping-fingers are fixedly secured on the shaft. A knife, operated by the shaft, passes through a bifurcated stop as it revolves. The invention is characterized by a simplicity of construction and efficiency of operation which leave nothing to be desired.

Electrical Apparatus.

FIRE-ALARM BOX.—HENRY F. BLACKWELL, JR., Manhattan, New York city. The usual type of fire-box is limited to one signal only, indicating the location of the box at a signal-station. The present invention provides the same box with a public signal, and with an auxiliary device or a series of auxiliary signal devices of different signal-numbers, adapted to be thrown into circuit from different buildings, so that a signal turned in will indicate the particular building connected with the box.

Mechanical Devices.

RAISIN-SEEDER.—CARY S. COX, Fresno, Cal. The seeder is provided with a reciprocating screen so constructed that nails and other foreign matter may be separated from the fruit before the fruit reaches the seeding section of the machine. The heating device employed to soften the fruit, avoids the necessity of steaming or wetting the raisins before they are placed in the seeder; consequently, a higher grade of product is obtained, free from the usual viscosity. In the seeder a heating roll receives the raisins, whereupon they are delivered to a carrying-roll provided with peripherally-toothed rings held separated. Brushes are located adjacent to the carriers, and are adapted to take the seeds from the roll, a device being also provided to remove the raisins from the roll.

RAISIN-SEEDER.—CARY S. COX and THOMAS E. LANGLEY, Fresno, Cal. This seeder is an improvement upon a device patented by Mr. Cox. The prime object of the present invention is the provision of a self-cleaning comb for removing the seed from the impaling roller, and of strippers particularly adapted to remove the seeded raisins from the impaling or carrying roller. The novel feature of the invention consists in providing the comb with serrated disks mounted to revolve adjacent to the periphery of the impaling roller, but out of contact therewith, whereby not only is the seed cleared from the impaling roller, but the short cap-stems on the raisins, the hard red berries, the nails, and other foreign matter are also effectually removed without injury to the impaling roller.

HYDRAULIC AIR-COMPRESSOR.—LEE E. MITCHELL, Boston, Mass. The inventor has devised a hydraulic cylinder and valve mechanism, which are automatically operated, so that the piston will continue to reciprocate until shut off by some outside means, the device being especially adapted for use in compressing air as the relative area of the water and air cylinders may be varied. The device is adapted to a wide range of work. It is thus possible to use water at high pressure economically for producing compressed air of low pressure or to use water of low pressure to produce compressed air of high pressure.

AUTOMATIC MACHINE-GUN.—ERNST TERNSTRÖM, Paris, France. In this gun the movement of the locking-lever, which prevents the movable bolt in the breech-piece from moving relatively to the latter in the closed position, is obtained by a resistance-plate acting on projections of the levers. This arrangement takes the place of the usual rack. The extractor is combined with a locking-lever, which prevents its premature disengagement from the cartridge, and the end of which also serves to raise up the bullet of the cartridge when inserted in the chamber and to prevent its abutting against the edges of the latter. The movement of the drum for feeding cartridges is controlled by a piece capable of being moved longitudinally.

WEB-FEEDING MECHANISM.—WILLIAM V. MILLER and ELIAS B. DUNN, Manhattan, New York city. When the moving pictures of a chronophotographic projecting apparatus appear in rapid succession on the screen, then the high lights of one picture appear passing over the dark portions of the preceding pictures until full registry is again had of the picture in the slide-opening during the period of rest; and, consequently, the picture appears blurred. With the new arrangement, the web or picture strip is set on edge and moves horizontally and intermittently past the slide-opening, the pictures being arranged one alongside the other, so that the high lights always remain in register and the web moves in the same direction as the depicted objects. Consequently, the pictures are bright and lifelike.

MACHINE FOR RUNNING CROSS-CUT SAWS.—HERBERT G. LOCKE, Arbuckle, Cal. A saw-reciprocating lever is pivotally mounted at its lower end on a base. A spring-bracket is secured to the base. One end of a rod is secured to the lever, and the other end is slidable through the bracket, so as to assist in guiding the lever. The sliding movement of the end in the bracket is limited to bend the latter. The weight of the operator is used in running the saw. The stroke of the saw can be easily regulated.

LOCK.—WINFIELD S. HOUSER, Bellefonte, Penn. The lock is springless and operates by gravity. The lock has a latch-bolt formed of a piece of steel bent on itself, its two sides being connected by a series of studs or rivets. A pivoted weight with teeth is arranged between the two sides of the bolt and meshes with the studs.

Railway Appliances.

CAR-WHEEL.—CHARLES P. JONES, Cleveland, Ohio. The inventor has so constructed a sectional metal car-wheel that the sections interlock perfectly and are positively held against movement upon each other, providing a wheel that is light, if not lighter than a solid or one-piece wheel, besides being much stronger and more readily preserved in condition for effective use.

CAR-BRAKE.—PETER SCHRIEFFER, New Orleans, La. The brake is particularly designed for electrically-operated-cars, and is adapted to be set quickly and tightly by comparatively little exertion of manual power. The electric controller is operated by the same means employed for operating the brake. The essential features of the invention are found in a rock-shaft upon which an eccentric is mounted. A brake-block is loosely mounted on the eccentric and carries a shoe and a weight on the side of the block opposite that of the shoe and operating to move the shoe out of engagement with the wheel.

CAR AXLE LUBRICATOR, DUST-GUARD, AND WIPER.—JAMES S. PATTEN, 403 Equitable Building, Baltimore, Md. The invention is an improvement upon a like invention of Mr. Patten's. The oil employed as a lubricant is held in the bottom of an axle-box, similar to that in ordinary use on railroads, and is taken up and transferred to the axle-journal by a rotating roller or wheel held in a V-shaped, swinging hanger pivoted in the arms of springs also supporting a dust-guard and holding it in place.

Miscellaneous Inventions.

PROTECTIVE TENT FOR TREES.—WILLIAM H. MCFARLAND, Titusville, Fla. The tent is designed for temporary erection about fruit-trees and other tender plants for protection against frost. A support having a pivot-bar is centrally located above the tree; and upon the support arms are mounted to swing. The arms carry the covering or tent which incloses the tree when the arms are properly spaced. A fixed curved support extends within the tent at one side and is adapted to engage and hold the bottom of the tent.

MITER-BOX.—CHARLES F. BOYCE, Malden, Mass. From a T-shaped base, a rigid pin projects upwardly; and upon the pin a semicircular table is mounted to swing over the base, the pin being centrally located with respect to the edge of the table. A spring dog is mounted on the base and serves to hold the table. A rock-shaft extends through the frame beneath the table. Saw-guides are respectively mounted at the ends of the rock-shaft and swing therewith. An angular collar is fastened to the shaft; and a spring-pressed rod engages the collar to hold the rock-shaft at any desired axial position.

LATTICED OR LEADED GLASS.—EDWIN R. CHILDS and GEORGE W. CANTRELL, Spokane, Wash. Cames receive the panes. On each came-face is a layer of solder, in which copper wires are embedded. Copper wire readily expands when placed in the melted solder. When the solder cools, the wire contracts, exerts an equal tension over the face of the window and holds the parts securely in position.

LOGGING-JACK.—ALEXANDER M. GILCHRIST, South Bend, Wash. The bar of the jack is provided with a hook located upon its lower end, by means of which hook it may be enabled to engage a log close to the ground, thus obviating the necessity of placing the upper end of the jack beneath the log. The construction of the casing is strengthened, so that the jack can be safely used for heavy work.

DEVICE FOR HOISTING GRAIN.—DAVID D. HILL, Logan, Kans. This hoisting-frame for grain consists of two side bars, at one end of which a cross-bar is fastened. A drop-bar is hinged to the side bars; and a latch for the drop-bar is carried by a side bar and is provided with a releasing lever. Retaining devices for the grain-receptacle are carried by the cross-bar and drop-bar. The device is portable and is especially adapted for hoisting headed grain to a wagon or stack.

GATE.—OLAUS B. JACOBS, Roland, Iowa. This gateway is especially designed to confine hogs and sheep in inclosures where they are allowed to run with cattle, and is so constructed that, while it will effectually confine hogs within desired limits, horses and cattle will be free to pass in and out. The gateway has a number of parallel partitions arranged to form uninterrupted passage-ways. The partitions are of such height and distance apart that short-legged animals are effectually prevented from passing through.

FIGURED DOUBLE PLUSH FABRIC.—HENRY LANGER, Brooklyn, New York city. The fabric consists of ground warps and wefts and pile-warps and a filling for the pile-warps. The pile-thread from its departure from the ground to its return connection therewith spans a number of picks and is of a length corresponding with the pile-warp thread, bound in a number of picks equaling the number of picks spanned. Various effects can thus be produced without the use of creels for the pile-threads.

COMBINED DOOR-HANGER TRACK AND WEATHER-SHED.—SAXTON J. MORGAN, Albany, Wis. The purpose of this invention is to provide a means for protecting the top edges of sliding doors from the weather, an end attained by a novel trackway, arranged so that it may carry a weather-shed over the top of the door and below the wheels, thus preventing the air from driving into the space between the door and the building.

FOLDING-BED.—JOSEPH J. MCINTYRE, Brooklyn, New York city. This folding-bed is so constructed that, when not required for sleeping purposes, it may be folded together to form an easy chair, provision being made in folding for the accommodation of the mattress

and pillows. When the bed is thus folded to form a chair, the back of the chair may be adjusted to any desired inclination like the back of a reclining chair.

SURGICAL APPLIANCE.—JOSEPH LEES, Summit Hill, Penn. The appliance consists of a shield carrying pads between which a receiver is located, constructed in adjustable sections. A warning mechanism is provided, with an electric connection between the sections of the receiver and the warning mechanism.

LETTER-CARRIER'S BAG.—MICHAEL MCCARTHY, Boston, Mass. The bag is an improvement upon a device of a similar nature. The box or holder is secured in one end of the bag and forms a wall at this end. The box or holder serves to carry letters, while the other part of the bag is adapted to carry other like packages.

TOOL-HOLDER.—CHARLES F. PRESTON, Chicago, Ill. The invention relates to tool-holders for lathes, planers, or other metal-working machinery, and provides a novel device of strong construction, which is arranged to carry one or two tools at the same time and to permit the ready setting of the tools in angular position, according to the nature of the work in hand. Two tools of the same or different character can be used at a time. One tool may be arranged for rough work and the other for finishing.

WHEEL-HUB.—FRANCIS J. VIEL, Blossburg, Penn. This inventor has provided a hub for carriage-wheels having pneumatic tires, by means of which hub the wheels can be readily applied to the axle-spindles of ordinary vehicles, thus permitting the interchange of the wheels with ease and without the necessity of disturbing the axles.

SHADE-ROLLER AND CLAMP.—HERMAN GUNTNER and ARTHUR A. ROBERTS, Wellsburg, W. Va. The shade-roller is an improvement in that class of curtain-rollers provided with a lengthwise groove and with clasps to secure the curtain in the groove. The novel feature of the present invention is embodied in the arrangement of the groove transversely relative to the periphery of the roller and the corresponding angle of the lips or flanges of the spring curtain-clasps, whereby the flanges are adapted to enter and secure the curtain in the groove.

Designs.

SUSPENDING-HOOK. — MAX ROBIN, Manhattan, New York city. The hook is designed to suspend an alarm-clock from the head of a bed in such a manner that the wood-work cannot be injured.

GAME-BOARD.—NEIL ROSS, Manhattan, New York city. The board is a glass checker-board of novel design, in which the squares are distinguished by colors painted in an ornamental fashion.

SEWER-TRAP. — ALFRED P. MORAN, Manhattan, New York city. The inventor has provided the sewer-trap with a man-hole formed at an obtuse angle to the outlet, so that a wire can be inserted from above to clean the outlet.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC

ARCHITECTURAL DRAWING. By C. Franklin Edminster. New York. 1899. Small 4to. Pp. 210. 96 plates. Sold by Munn & Company. Price $2.

The author is instructor in mechanical drawing in the Pratt Institute and is thoroughly competent to prepare a text-book on the subject. In many ways it is one of the best works we have seen on the subject, as regards real helpfulness. The number of mediocre books on architectural drawing is legion, but this work is not in their class. It gives exactly the kind of information for which the architectural draughtsman is always in need. We wish to accentuate the value of this book both for use in schools and by the student working by himself. The illustrations are well reproduced and are carefully drawn.

OUR NATIVE BIRDS. How to Protect Them and Attract Them to Our Homes. By D. Lange. New York: The Macmillan Company. 1899. 16mo. Pp. 162. Price $1.

The wanton destruction of birds is one of the most cruel manifestations of our modern civilization, and anything which can be done to mitigate it will be welcomed by all right-thinking persons. The present volume is one of the best briefs for the bird we have seen, and we wish it all success. A concerted effort to abate the evils and to promote the love of birds would certainly be productive of much good.

IRRIGATION AND DRAINAGE. Principles and Practice of their Cultural Phases. By F. H. King. New York: Macmillan Company. 1899. 12mo. Pp. 502. Price $1 50.

The present volume belongs to the Rural Science Series, and is devoted to what we might call the "new" agriculture. They say you cannot farm by a book; it is doubtful if this old saw is true to-day. Any farmer would profit by the perusal of this book, and it has been placed within his means. Drainage is one thing which the farmer can often control at little expense, and it behoves him to do it.

POWER TRANSMITTED BY ELECTRICITY AND APPLIED BY THE ELECTRIC MOTOR. By Philip Atkinson, A.M., Ph.D. New York: D. Van Nostrand Company. 1899. 12mo. Pp. 241. Price $2.

The subject of the electric transmission of power has increased so much in importance since 1893, that a new and revised edition was called for. The work is clearly written and can be comprehended by all.

MAP SHEET OF TWO WARS. Buffalo, N. Y.: Matthews-Northrup Company. Price 10 cents.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7820) J. B. asks: What is the construction of lyddite shells? In what does their peculiarly destructive effect consist? What is lyddite? How manufactured? A. A lyddite shell consists of a cartridge terminated by the projectile. The charge which forces the shell is contained in its base and consists of 12 pounds of cordite for the 4·7-inch gun. The shell itself forms the upper part of the projectile. It contains the bursting charge of 10 pounds of lyddite, and the percussion fuse is screwed into its base. A space is left between the cordite charge and the shell in order to insure a gradual action of the gases upon the shell, whereby the strain upon the gun is lessened. Lyddite is a picric compound; its manufacture is a secret. Its peculiarly destructive effect is caused when it is used as a bursting charge, by the number of pieces into which the shell is broken and the energy with which they are thrown.

(7821) C.W. asks: 1. How can I tell the insulating quality of glass to be used for a Wimshurst machine? A. Put tinfoil on the opposite sides of the glass, charge it as a Leyden jar and see if it retains the charge. If it will hold the charge it is good. 2. A recent issue of the SCIENTIFIC AMERICAN (query column) speaks of a sectorless Wimshurst machine. What is meant by a sectorless machine? How does such a machine work? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1131, price 10 cents, for this machine. 3. Would 2½-inch diameter brass tubing be sufficiently large to make the prime conductors of a Wimshurst machine with eight plates of 24-inch diameter? A. Yes.

(7822) C. R. writes: Noticing that it is hard to tell different colors by lamp light (artificial light), such as yellow from white, certain shades of blue and green apart, are there spectacle lenses that will correct the vision? A. The reason of the difficulty of which you complain is that the colored object absorbs the light of the lamp and does not reflect it. Hence the light does not come to the eye so as to make the object distinctly seen as to its color. Since the difficulty is in the nature of the light and the object, there can be no remedy found in glasses to be worn. The remedy is to get a light which is nearer the sunlight in color.

(7823) F. A. H. asks: 1. Do you know of any book that illustrates the wiring of different dynamos, motors, and switch boards? A. There are a number of valuable books on the winding of dynamos. We can furnish you Thompson's "Dynamo-Electric Machinery," 2 vols., with American Supplement, $7. Parshall and Hobart's "Armature Winding," price $7 50. Weymouth's "Drum Armatures and Commutators," price $3. 2. Also one for telephone, giving the different classes of wiring for inside work? A Upon the telephone: we have Preece and Stubbs' "Manual of Telephony," price $4.50. Miller's "American Telephone Practice," price $2. Hopkins' "Telephone Lines," price $1.50.

(7824) A. P. P. asks: 1. Is the negative electrode of a cell attached to the negative plate? A The electrodes of a cell are the free ends of the wires attached to the plates. The free end of the wire attached to the positive plate is the negative electrode, and similarly the positive electrode is connected with the negative plate. In all batteries using zinc, the end of the wire attached to the zinc is the negative electrode, since the zinc is the positive plate. 2. Can an ice boat make faster time than the average velocity of the wind that is blowing? A. This question was very hotly debated several years ago, the result being the demonstration of the fact that ice boats did sail faster than the wind was blowing by which they were propelled. SUPPLEMENT, No. 214, price 10 cents, has an interesting article upon this subject.

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(Continued on page 94)

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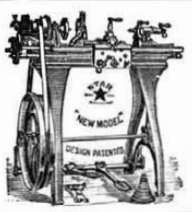

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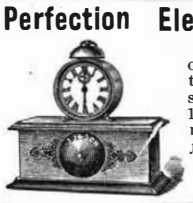

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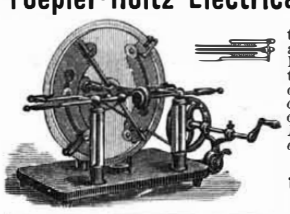

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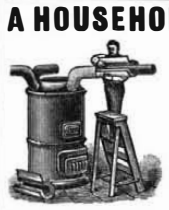

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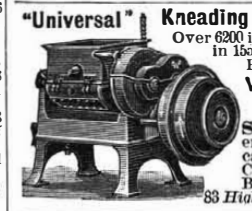

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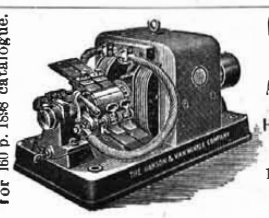

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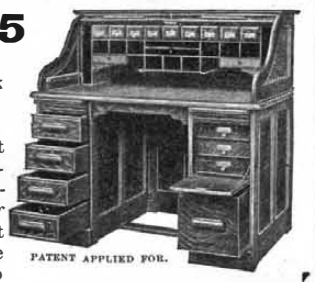

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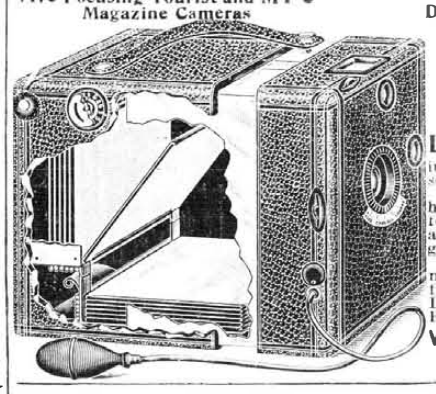

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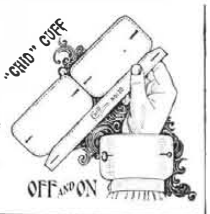

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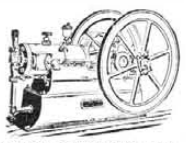

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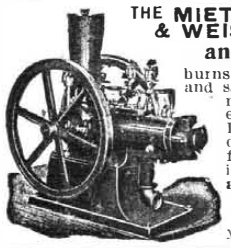

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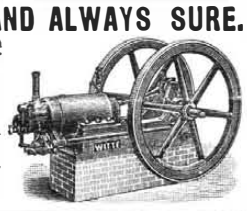

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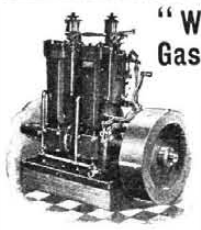

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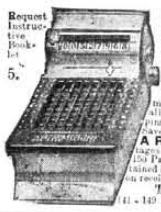

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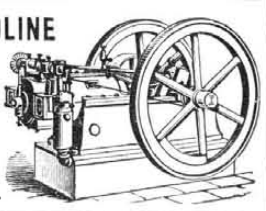

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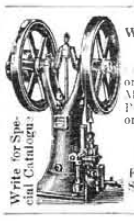

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